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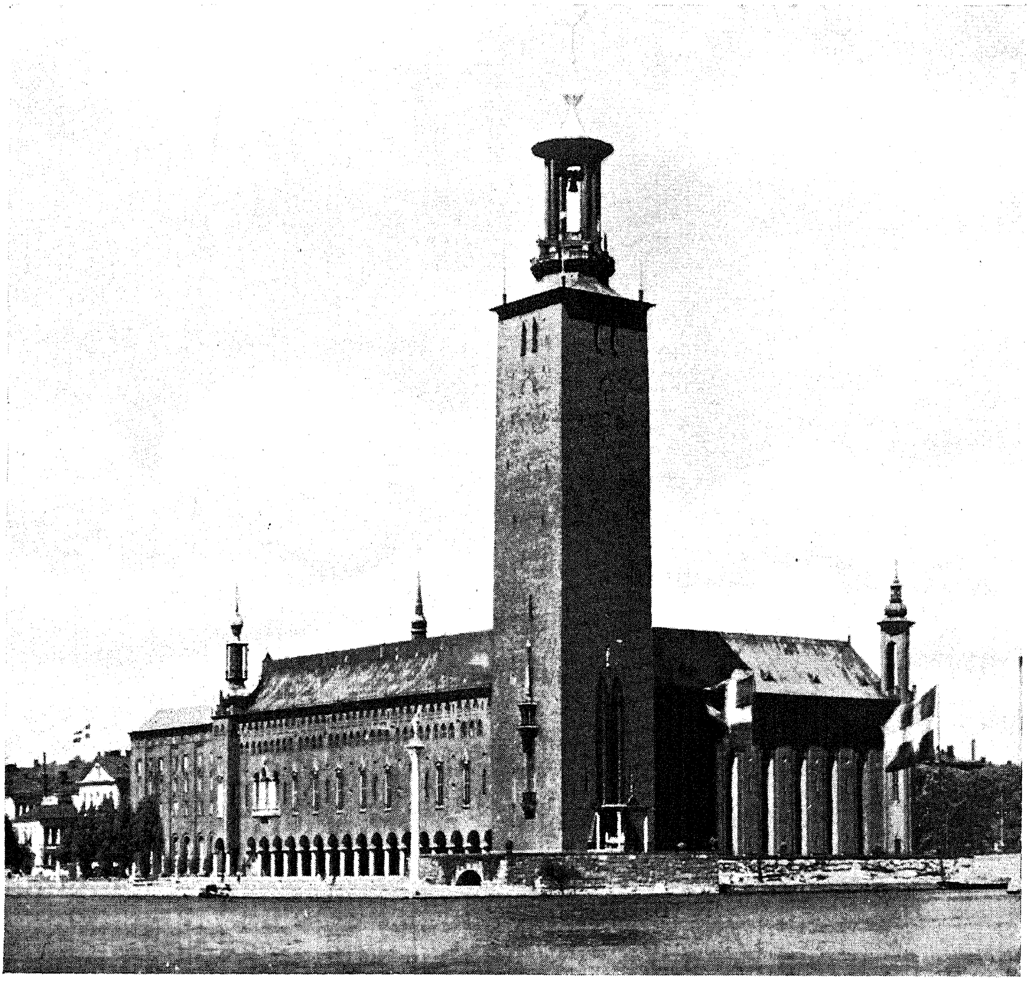

THE CITY HALL OF STOCKHOLM (COMPLETED 1923), ARCHITECT: RAGNAR ÖSTBERG

European Architecture
IN THE TWENTIETH CENTURY

BY

ARNOLD WHITTICK

Volume One

PART I

HISTORICAL BACKGROUND AND THE EARLY YEARS OF THE CENTURY

PART II

TRANSITION FROM WAR TO PEACE
1919–24

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TO MY WIFE

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PREFACE

THIS history is designed to cover the first half of the twentieth century. It is divided into five parts which are to be presented in three volumes. The first volume contains the first and second parts and takes the narrative to the year 1924. The second volume will contain the third part, covering the period from 1924 to 1933, while the third volume will contain the fourth and fifth parts covering the periods from 1933 to 1940 and from 1945 to 1950.

In part one it is my purpose to give a general idea of the architectural background at the beginning of the century and to review the principal developments before the First World War. I have not felt it necessary to go back in any detail farther than the late Renaissance, because architectural history before that time has been variously systematized and is available in numerous text-books. Thus I begin broadly with the main European developments since the late eighteenth century, giving a little closer attention to the architectural movements of the second half of the nineteenth century and early twentieth century, allowing the treatment to become gradually more detailed as the year 1914 is approached. The division into the periods indicated seem to be those which are most logically suggested by the course of European history.

I have generally considered buildings in chronological order, being governed rather by the date that a building was designed or begun than by the date it was completed, unless the modifications in the original design were such as to assign it more fittingly to a later date; because a history of architecture is very much an account of the evolution of architectural thought. One of the results of this method is that sometimes, although not often, a building is given a much earlier place in the historical sequence than the date of its completion would suggest.

To assist clarity and to avoid as much as possible uncertainties of meaning, it is, I think, desirable to give some indication of the sense in which the term 'architecture' is employed in this work. The term architect derives from the Greek *ἀρχιτέκτων*, a compound of *ἀρχι-* meaning 'chief' or 'master' and *τέκτων* meaning 'carpenter', 'craftsman', or 'builder'. According, then, to its original definition, architecture is the work of the architect or master-builder. In modern aesthetic philosophy, however, architecture has been given a more exclusive meaning. It is here classified with painting, sculpture, music, and poetry as one of the fine arts and is regarded as building which has some degree of beauty, or, in other words, building that has aesthetic interest. It is primarily with architecture in this latter sense that this book is concerned.

I think the term 'building' adequately denotes the activities of the architect or master-builder in its original meaning. If there were no such term to comprehend the craft or science of building, then there would be little justification in using the term architecture in the restricted aesthetic sense, but building serves the wider sense very well.

In dealing with architecture, however, I have endeavoured to comprehend everything in building that may help to determine aesthetic character, and I have thus considered as fully as possible the social and scientific aspects of building. The definition of good building that has been most usual in England in the period between the two wars is that of Vitruvius, who, after classifying the types of public buildings, says: 'Haec autem ita fieri debent, ut habeatur ratio firmitatis, utilitatis, venustatis' (Book 1, Chapter 3). These last three terms may be translated as firmness or strength, utility, and grace or beauty or delight. The influence of this definition on modern English architectural thought is partly due to Sir Henry Wotton's paraphrase of this passage as 'Well building hath three conditions. Commoditie, Firmeness, and Delight' in his *The Elements of Architecture* (1624), an edition of which was published in 1903, but more significantly to Geoffrey Scott's accepting it as his starting-point in his brilliant *Architecture of Humanism* (1914). Although realizing the importance both of 'Commoditie' which is the satisfactory fulfilment of purpose, and 'Firmeness' which is constructional efficiency, he emphasized that it is the delight which the building gives which makes it architecture. Scott thus uses the term in the restricted aesthetic sense.

Although being guided by this aesthetic interpretation of the term 'architecture', I have felt that it is essential to comprehend the requisites of good building as defined by Vitruvius and to give an account of the developments of architecture with reference to the technical problems of construction and the various purposes for which the buildings are erected. As R. G. Collingwood pointed out in his *Outlines of a Philosophy of Art* (1925), 'the force which transforms art from one shape to another . . . is not art, it is that force which reveals itself in history as a whole, the force of the spirit. Hence no event in the so-called history of art can be explained by reference to the principles of art itself. To explain the history of architecture we must study the technique of building construction and the social purposes which buildings are erected to serve.' Thus I have sought for the explanations of the changes in the appearance of buildings mainly in the developments of the craft of building and science of construction and in the satisfaction of social needs. If, therefore, I often dwell at considerable length on the social needs and on the structural aspects of building, I have done so always with the intention of showing how these have contributed, either directly or indirectly in the course of historical evolution, towards providing that delight by which building becomes architecture.

ARNOLD WHITTICK

BECKENHAM
April 1949

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PART I

HISTORICAL BACKGROUND AND THE EARLY YEARS OF THE CENTURY

CHAPTER I

Revivalism

AT the beginning of the twentieth century the revival of the great architectural styles of the past had almost spent itself and was dying. Yet the age of revivals forms one of the principal backgrounds of many modern architectural developments and it is important to understand the essential principles of the kinds of architecture that it was attempted to revive. It is unnecessary to explain why a revival, which is merely a revival without development, cannot itself produce a great architecture more than to say that the vitality which can only arise from contemporary social and spiritual needs, and which is necessary to great art, cannot exist in a revival of a style which belonged to a remote and necessarily different mode of life. To revive an art successfully it is necessary to revive the kind of life that produced that art. Some have realized this and have established small communities imitating the life which had been the setting of the art they wished to revive. Such communities, by their remoteness from contemporary life and by their cancellation of much material and social progress, really demonstrate the impossibility of successful revival. The gradual and somewhat conservative development from old forms and styles that we see in much Renaissance work is different.

Before the eighteenth century European architects had reached Greek architecture mainly through Roman architecture and the interpretations of Vitruvius. But towards the end of the eighteenth century artists and scholars began to travel in Greece, Asia Minor, and what were once Greek colonies, while Greek sculptures and architectural fragments and drawings of Greek temples began to be transported to the museums of Europe, the transportation by Lord Elgin of Parthenon fragments to England in the early nineteenth century being a noteworthy example. The classicism of seventeenth- and eighteenth-century literature and the desire for classical perfection in art which had been a passion with Winckelman, and which had passed in a modified form to the influential figure of Goethe, prepared the ground for the enthusiastic reception of the more complete material revelation of Greek art; and these, with the Renaissance preparation, resulted in the Greek revival of the late eighteenth and early nineteenth centuries. It was the strongest and most widespread of European revivals and manifested in every important capital in Europe. The adaptation of Greek architecture to various types of building was done with varying success. There is little distinction between buildings of different capitals, and it would be possible to join the parts of London, Berlin, and Leningrad in which groups of buildings of the classical revival are situated without any feeling that they are a mixture of buildings from different parts of Europe. In Leningrad some of the classical buildings were designed by foreign architects, principally French and the Scottish architect, Charles Cameron, who had been invited for that purpose.

Throughout this classical revival there is a general tendency to go farther and farther back so as to imitate the original classical architecture of the sixth and fifth centuries B.C. In the initial stages a mixture of Hellenistic influence is apparent, but with greater familiarity with the original Greek we find a closer adherence to the beautiful proportions of the Greek temples. The exterior of the Madeleine in Paris, designed by Vignon in the early years of the nineteenth century, is a fairly close imitation of the Greek temple, the *cella* being adapted to the needs of a modern church. In Elmes's St. George's Hall, Liverpool, completed in 1839, the inspiration of the Greek temple is obvious, but its purpose of Hall and Law Courts involves more originality in adaptation, and this is done with such sublety and refinement as to make it one of the flowers of the Greek revival. This building has had great influence on much subsequent architecture in Liverpool, many municipal and other buildings in the vicinity being designed to conform with it. In the British Museum, built by Sir Robert Smirke between 1823 and 1847, the Parthenon is largely taken as a model, although the Ionic order is employed instead of the Doric. In the classical revival of Germany and Russia there is a stronger movement towards Greek sixth- and fifth-century work. In Klentze's work in Munich and more particularly in Schinkel's work in Berlin, the classic Doric and Ionic architecture of Athens is followed in such works as the Museum of Antiquities, the New Theatre, and other buildings all of the first half of the nineteenth century. We find this striving towards classical purity very strong in Leningrad, the Doric temple at Paestum, older than the Parthenon, serving as the principal model, the Bourse building being a partial reproduction. So anxious were the architects to reproduce what they imagined to be the original Greek effects that they coloured many of their buildings.[1]

Slightly later, partially as a revolt against this supposed cold and scholarly art (although I think it was produced by many artists with deep emotion and enthusiasm as in the case of Ingres), there arose the romantic movement, itself partially a revival of the romanticism of the Middle Ages. Significant figures for architecture are romantic novelists like Mrs. Radcliffe, Scott, and Horace Walpole who writes *The Castle of Otranto* with its medieval setting and artificial mysteries, and who builds the quaint Gothic contraptions at his villa on Strawberry Hill between 1753 and 1778, which was for many years a lone herald of the Gothic revival.[1] The Romantic movement spread throughout Europe flowering chiefly in Germany, England, France, and manifesting in literature, music, and painting, hardly touching sculpture, and apparent in architecture as the Gothic revival and partially as a more pregnant romanticism with which I will deal in a subsequent chapter. The Gothic revival developed chiefly in England, in Germany and the Scandinavian countries, in the Low Countries, and to a less extent in France, but it was not, with the exception of England, so widespread as the Greek revival. It may be said of the Greek and Gothic revivals that they sought to imitate as closely as possible their originals. The closer their buildings were to such originals the better their authors were pleased. The Brandenburg Gate is closer to a Greek gateway than is a Roman gateway, and St. George's Hall, although being much nearer in purpose to a Roman basilica than to a Greek temple, is much more like a Greek temple than was a Roman basilica. The point is that Roman architecture developed from Greek, but in these examples of the modern classical revival close imitation of Greek buildings is attempted.

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[1] Reproductions of coloured elevations of four classical buildings in Leningrad are given in the *Architectural Review*, vol. lxxi, May 1932. Plate III.

Originality and design were necessary in adapting these styles to buildings of which there were inadequate prototypes. In the Houses of Parliament (1840–60) for which Sir Charles Barry made the plan on classic lines and Augustus Pugin the Gothic dress, the Parliament Buildings at Budapest (1855–70) by Steindl, and the Law Courts (1874–82) by G. E. Street the Gothic style was used with less sense of incongruity than for railway stations and insurance offices. With churches there could be the strictest imitation, as in so much of the mechanical work of Sir Gilbert Scott and of Gothic castles in Bavaria, and here we have much almost perfect copybook architecture—complete mechanical reproductions without the vital spark to give them life. The adaptations of Greek temples to Parliament buildings, town halls, museums, and other institutions are legion, and they are generally of greater merit than Gothic revivalist work because they are often of excellent scale and proportions where columns, walls, and openings are well related.

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[1] This was many years before Wyatt's Fonthill Abbey, the second important example of the Gothic revival in England, which was built in 1796–9.

The dignity and repose of classical architecture is more often a successful reminiscence than the aspiration of Gothic, even in churches. The inevitable reflection is that classical architecture is more flexible and easier to adapt than is Gothic.

It has often been said that a Greek temple and a Gothic cathedral are the most perfect creations of architectural genius yet evolved, and that Greek and Gothic represent absolutely antithetical styles. As this is pertinent to certain later architectural eclecticisms it is important to be fully conscious of what the essential qualities of each are. I will consider now only certain aspects of the contrast, and I will deal more fully with the life that each style expresses when considering a certain modern eclecticism.

The Greek temple has, more than any other building, determined the classical tradition in architecture. It was built to house the image of the god, and the people worshipped in the open with the temple in view. Generally only priests entered. Thus the exterior of the temple, being before the eyes of the people as they worshipped, and being the home of the god, was made as grand and impressive as possible. And when sculptors like Phidias created the gods in gold and ivory they were idealized beyond any particular individual, and were given a majesty and calm that was conceived as godlike. The temple was built in harmony, and the pervading qualities were majesty, grandeur, and repose. The Greeks were great geometricians, and, like some modern mathematicians, they believed that the universe obeys mathematical law, and that its mysteries might be solved by mathematics. In building and architecture geometry was a profound influence. Greek temples were built according to the strictest symmetry, and although many of the architectural forms could be traced to organic origins, they clearly endeavoured to order them on a geometric basis. Thus has been established the classical tradition of architecture, where grandeur of appearance, symmetry, and geometric planning are conspicuous features. As a result of the influence of the architecture of the temple on buildings of more utilitarian purpose convenience and efficiency are often subordinated to these principles.

A larger Greek temple like the Parthenon, or the temple at Paestum in southern Italy, was a simple walled building called the *cella* in which was the image of the god, and this was surrounded by a peristyle, with single rows of columns at the sides and double rows at the front and back. The temple was covered with a sloping roof which permitted a pediment at either end generally filled with sculptures. A small temple consisted of the *cella* with columns and pediment at one end with walls of the *cella* built between the side columns or pilasters appearing in the walls. There are numerous stages between these two. It is important to note that in the *cella* the walls are structural and supporting, and that apart from surrounding columns, all Greek, Roman, and Renaissance buildings follow this method of the solid structural wall, and that much of the effect of Roman and Renaissance building depends on the impression of weight and mass given by the solid supporting wall.

A Gothic cathedral is the most formal of medieval buildings, and this is due partly to Roman influence in planning, but more, I think, to the symbol of the cross which forms the plan of most Gothic churches. But if we consider the plan of monastic buildings, or of a medieval castle or manor-house, we find an irregularity very different from classical symmetry. This irregularity is clearly the result of planning according to convenience. Monastic buildings are generally planned in conformity with a certain layout with the cloisters to the north or south of the nave and the refectory on the further side with the chapter house and dormitory to the east, and the other buildings grouped round. The whole arrangement, though similar in numerous examples, is irregular and is entirely different from formal symmetrical planning of Greek and Roman buildings. It may be argued that the layout of the buildings on the Athenian Acropolis is not formal and symmetrical, but irregular. It was the purpose, however, in placing these buildings to present to those entering the Propylea the most impressive view of the temples, and this is done by placing them slightly diagonally to the percipient from the Propylea. Appearance is thus an essential purpose.

The feeling of religious aspiration that the long vertical lines and the pointed arches of a Gothic cathedral express, and the sense of mystery so often suggested in the lofty interiors by lines of the arches being lost in the shadowy vaulted roof, I refer to again. The transition from Romanesque to Gothic meant, however, a change from walled to framed structure. The structural reasons for the change was to obtain a wider span, and to facilitate the vaulting and roof intersections over rectangular spaces, which is explained in numerous text-books.[1] The vaulting was made possible by the use of buttresses to take the outward thrust. The whole became a framed structure, and made possible the large windows familiar in Gothic cathedrals. It will be seen later that there are certain similarities in this framed structure and the modern steel frame.

During the latter part of the nineteenth century there was a growing restlessness among many architects resulting from a dissatisfaction with a mere imitation of past styles. Many architects looked back again to find other styles to revive, some turned again to the Renaissance traditions of the eighteenth century, some tried to devise a totally new style expressive of the age, one manifestation of this being *L'Art Nouveau.*

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[1] Good explanations are given in Sir Banister Fletcher's *History of Architecture on the Comparative Method*, twelfth edition (London, 1945), pp. 328–31.

Among the styles that architects of the late nineteenth century sought to revive were Byzantine and Romanesque. This was particularly so in Germany and France, where numerous churches were built during this period in Byzantine and Romanesque styles or a blending of the two. Examples of modern French Byzantine churches are S. Pierre de Montrouge, by Joseph A. E. Vandremer, and the church of Fouviere at Lyons, finished in 1884. The cathedral of Marseilles built by Leon Vandoyer and Henri Espirandieu is a mingling of Romanesque and Byzantine, and many smaller churches, like the church of S. Luc at Nîmes, are built in a similar way. Perhaps the finest modern Romanesque Byzantine building in France is the great church of Sacré Cœur in Paris, built in the last years of the century to the designs of Paul Abadie. The old Trocadero, built for the exhibition of 1878 and destroyed to make room for a new one for the exhibition of 1937, was a modern adaptation of Romanesque. Revival of Romanesque is strongly apparent in England, either as a modern adaptation of the style or as a prominent ingredient of eclectic work. A familiar example of the former is Alfred Waterhouse's Natural History Museum at South Kensington, built in 1879. It would seem that in the later stages of the Gothic revival, in the effort to produce something fresh, architects went farther back in time to periods prior to Gothic, a tendency which, we have seen, occurred with the Greek revivalists. Later still there is a movement to revive Egyptian styles.

Paris had been the art centre of Europe in the eighteenth century and it continued so during the nineteenth century, and artists from every country were constantly looking to this centre for guidance. I do not think French influence has ever been mentioned for the adoption of the Byzantine style for Westminster Cathedral. It is possible that its adoption for many modern French churches had some influence in forming the decision, especially as Westminster Cathedral has certain French Romanesque elements. The decision was taken by Cardinal Vaughan because, it was argued, if built in the Byzantine style the shell could be erected fairly quickly and thus the church could be ready for use in a short period while the interior decoration could be continued in the course of many years, as funds were available. Also, it was argued, the Byzantine style would make possible a wide open nave and choir and would thus be suitable for preaching to a large congregation. There was also a reluctance to build in the Gothic style because of competing with Westminster Abbey, but the stronger objection to Gothic was probably because each part is finished as it is built, the decorations being more an integral part of structure than in Byzantine work, and thus it would be far longer before the church could be used. John F. Bentley, the architect, studied for the work in France, Italy, and Greece, giving especial attention to Italian Byzantine churches and Santa Sophia. The plan is closest to that of the French Romanesque cathedral at Angoulême, but St. Marks and Santa Sophia are the principal inspirations from which many features are directly borrowed. Many of the marbles used extensively in Santa Sophia are being used in Westminster Cathedral. One somewhat romantic episode is connected with the columns of the nave. When William Brindley discovered the quarry which had supplied the *verde antico* marble columns for Santa Sophia, he found several worked columns lying in the quarry like those at Santa Sophia, and these were used for some of the columns at Westminster.

It is not possible to judge the effect of the interior until the marble and mosaic decorations are completed, for the dull greyish-brown bricks of which it is constructed give a cold effect. There is a certain sense of space, although the spaciousness is not exhilarating as in St. Paul's Cathedral, but rather chilly and forbidding. This may be overcome when the brick walls are covered with marble and mosaics, but judging from the parts that are finished it is likely to reduce the effect of space and lessen the sense of mystery that at present is suggested by the dim light that pervades the vaulted roof. The exterior is less satisfying than the interior. Like so many Byzantine exteriors it seems to be a collection of small parts, without any suggestion of a principal dominating form. Also it looks a foreign and somewhat oriental importation into the life of a western city, completely remote from surrounding life. If a criticism is implied here, it might be replied that a building designed for religious devotion can legitimately be in contrast to surrounding buildings. St. Paul's Cathedral, on the contrary, has stylistic kinship with numerous city buildings, and seems much more at home than does Westminster Cathedral.

CHAPTER II

Later Revivalism and Renaissance

THE striving for originality among European architects at the end of the nineteenth century and in the early years of the twentieth took many forms. I shall have occasion later to note the more valuable of these endeavours among a progressive minority. The majority of architects still sought for inspiration in the great architectural styles of the past rather than in the scientific and social developments of contemporary life. The principal movements based on revivalism were a freer treatment of Classical and Gothic architecture, the latter chiefly in ecclesiastical work, a movement that was to have many interesting results later; a return to Renaissance architecture before the period of the Greek revival;[1] and a revival of, or rather an incorporation of features of other, more remote, architectural styles like Egyptian, Assyrian, and Saracenic. Often there was a mixture of many styles which resulted in eclecticism, which was generally most successful when one style dominated. I will deal with the more serious eclecticism in the next chapter. It is the intention at present to consider later classical revivalist work, and the revival of early Renaissance architecture.

In the desire for freer treatment of classical architecture, and in the revival of various phases of Renaissance work, there appeared a stronger expression of national characteristics, and it is not difficult to distinguish the work of different countries by distinct qualities. Later German Renaissance work, for example, has a massiveness and heaviness in contrast with more ornate and lighter late French Renaissance work; and the return to early periods of Renaissance was generally influenced by those native traditions with which early Renaissance work was mingled.

The freedom of later classical revivalist work is seen in such buildings as the Palais de Justice, at Brussels, by Polaert, completed in 1883, the Exchange in the same city, and the Paris Opera House (1874) by Charles

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[1] For the history of Renaissance architecture the reader is referred to the many excellent works on the subject, among which may be mentioned *The Architecture of the Renaissance in Italy*, by W. J. Anderson and A. Stratton (1927); *A History of French Architecture 1494 to 1661*, 2 vols. (1911) *and 1661–1774*, 2 vols. (1921), by Sir Reginald Blomfield, also his *A History of Renaissance Architecture in England* (1897). There is a good classified account in Sir Banister Fletcher's *History of Architecture* (twelfth ed., 1945), and a good short survey in Nikolaus Pevsner's *An Outline of European Architecture* (Penguin Book, 1942).

Garnier. These buildings represent various degrees of freedom in the treatment of classical architecture, the first mentioned being perhaps the most Greek in character, while the last has a florid character in much of its ornament reminiscent of Baroque, although it is essentially classical in spirit.

For the Paris Exhibition of 1900 were built the Grand Palais by Thomas Louret, and the Petit Palais (Plate II) by Charles Girault. The latter is the finer building and it has had considerable influence on twentieth-century Renaissance architecture. The Ionic colonnade appearing on the façade of the building, the entrance with the semicircular entablature abutting the central dome, and the sculptured embellishment are all very happily proportioned and related. Although there are numerous ornamental features they all keep their place and are all subordinated to the main lines of the design. One feels that this building is typically French, and many English buildings of the twentieth century with a distinctively French character owe something to it. This influence is particularly apparent in the work of two firms of architects: Lanchester, Stewart & Rickards, and Mewès & Davis. The former were responsible for Cardiff Town Hall and Law Courts, completed in 1906. The treatment with the horizontally recessed masonry joints, the application of ornament and sculpture, and the light effect accomplished by the use of sunk panels and concavities is strongly reminiscent of work like the Petit Palais. Lanchester & Rickards designed the Central Wesleyan Hall, Westminster (1906–12), in which there is the same treatment of masonry and application of ornament, and the use of a square dome similar in shape to the two square domes of the Petit Palais. The spaciousness of every part of the interior is noteworthy.

Charles Mewès, who died in 1914, was an architect of international scope. He not only did a considerable amount of work in his native France, but also in Germany and England. In his German work he was assisted by A. Bischoff, and in his English work by Arthur J. Davis, who had been trained at the École des Beaux Arts. We have to thank Mewès & Davis for the introduction of French lightness and elegance into London architecture. The most important works are the Ritz Hotel and the *Morning Post* building in the Strand, both erected in 1906, and the Royal Automobile Club building in Pall Mall, completed in 1911. These three buildings are more restrained than most contemporary French work, and ornament is used sparingly and with taste. The Ritz Hotel was the first steel frame building in London, but it retains the massive-wall character of a Renaissance building, for which London County Council requirements may be partly responsible. It is simple in treatment, with a very happily proportioned arcade over the footway. The *Morning Post* building (see Plate IV) is even more successful. The adaptation to an awkwardly shaped site has been made with consummate skill, and resulted in a building where lightness and refinement are prominent qualities. It is in marked contrast to the heavy and clumsy Gaiety Theatre building on the opposite corner, designed by Norman Shaw. Unfortunately when the *Tatler* and *Sketch* took the building they did much to spoil it when they added two storys, thus disturbing the fine scale and proportion of the building. The Royal Automobile Club building is again distinguished for French elegance, having a grace of line and detail which helps to make it one of the most attractive club buildings in London, while it has notes of revivalism, symptomatic of the time, in the Egyptian Swimming Pool and Greek Turkish Bath.

There was much official building in London and other British cities during the early years of the twentieth century. Many buildings in Whitehall were erected and appear for the most part as free treatments of classic architecture, with the traditions established by Inigo Jones and Chambers exercising a strong influence. Such work as the War Office (1906), designed by William Young, and the Government Offices in Whitehall (1908), designed by John Brydon, are examples. They are somewhat fat and heavy, and neither has the distinction and excellent proportions of Sir Gilbert Scott's much-abused Foreign Office. Similarly heavy, where masonry is inartistically obtrusive, is the London County Hall, designed by Ralph Knott, begun in 1912 and completed a few years after the First World War. Its pitched tiled roof with tall chimneys characteristic of medieval buildings seem out of harmony with the heavy Renaissance façades. The horizontal implications of the river front are ignored, especially in the recessed semicircular central façade with its colonnade. In the building as originally planned this central feature was placed on the other side, where it would have been better, but Norman Shaw, being one of the assessors, liked it on the river front, and his wishes appear to have prevailed. There is little to justify it. The purpose of the building does not demand it, and, as C. and A. Williams-Ellis[1] have aptly remarked, it 'eats into the accommodation as a boy's bite into a sponge cake'. The opportunity of a fine river front has been missed.

Renaissance architecture in Germany in the late nineteenth century seems to vary between classical Renaissance and Baroque. The Reichstag building in Berlin by Paul Wallot (Plate II), erected about 1890, has a classical colonnaded façade with central pedimented portico and rectangular glass dome, all suggestive of French influence. Berlin Cathedral, by Julius Raschdorff (Plate II C), built in 1893, is reminiscent of Italian Baroque. It has a central dome with four corner turrets, with a main entrance not in the centre but at the side. It has a very ornate and 'cut up' effect, the two-storied façades being made up of numerous small features which destroy what grandeur a simpler treatment of a building of this size might have achieved. Later German Renaissance work became simpler, due partially to the influence of Ludwig Hoffmann, who designed the massive Imperial Law Courts at Leipzig, completed in 1895, and the Town Hall at Berlin, completed in 1912. The latter has something of the massiveness and heaviness that seems to make some later German Renaissance architecture expressive of German character.

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[1] C. and A. Williams-Ellis, *The Pleasures of Architecture* (London, 1924), p. 221.

The square character and restraint of the Royal Palace at Stockholm, designed by Nicodemus Tessin during the late seventeenth century, seems to have influenced later Swedish Renaissance architecture and encouraged Greek influence. Swedish classical buildings during the twenty years prior to the First World War have this square character. They are designed with more simplicity than contemporary French work. The Royal Opera House at Stockholm (Plate II D), completed in 1898, and the Houses of Parliament (Plate III), designed by Aron Johansson and completed in 1905, are examples. There is considerable plain wall-surface in the former example, while the dominating features of the latter are the long colonnades decorating the principal façade in which is a square-topped central feature. Another important work of Aron Johansson is the new building of the National Bank of Sweden, Stockholm, completed in 1906. Here the influence of early Florentine palaces is apparent in the rusticated masonry of the ground floor, but again the paramount influence is the Royal Palace, which determines the large rectangular blocks, while the classic revival is responsible for the introduction of Corinthian pilasters and the application of Roman ornament.

We have noted some of the influences of the Paris Exhibition in 1900. Among its legacies must be reckoned that wild riot of ornament and decoration which manifested in the Milan Exhibition of 1906. The buildings of the Paris Exhibition were certainly ornate in character, but the architects of the Milan Exhibition, in their profuse use of ornament, seemed determined to leave the French Exhibition well in the shade. In these Renaissance buildings almost every available space is decorated with enrichments, cornices, pilasters, and human, animal, and vegetable sculpture, often of a symbolic character. I am unaware whether it was intended that any of the buildings should be permanent, but a fire which destroyed many of them mercifully decided otherwise.

But such a manifestation was rather the exception than the rule in Mediterranean countries, for later classical revivalist work in these countries is generally less free than in the countries of northern Europe. The most famous work of the kind was the Monument of Vittorio Emmanuele at Rome, by Sacconi, built to commemorate Italian national unity, effected after 1870. The monument is on a grand scale, being over 400 feet long and 200 feet high. It consists of an equestrian statue of the king mounted on a pedestal on a terrace approached by steps at either end. At the back of this is an immense colonnade, each column being 50 feet high between two flanking projecting blocks faced with porticoes and surmounted by bronze groups. This huge monument has an appropriate setting, being the terminal feature of the Corso Umberto, and is thus seen to advantage. It is largely classical in conception but savouring of the grandeur and ostentation of Rome rather than the dignity and austerity of Greece.

In marked contrast to the late free classicism of northern European countries is the classical revivalist work in Athens itself, purer and closer to originals, it seems to me, than the earlier work in Berlin, Liverpool, or Leningrad. One explanation is obviously that the power of the Greek originals is more immediate and dominating than it could be elsewhere.

After Greek independence in 1830 modern Athens was built to the north of the Acropolis. Parts of the medieval city were included, but these formed only a small part of the modern city. The plan of the new Athens was the work of the German architect and archaeologist, Schaubert. It is a symmetrical geometric plan in the classical tradition. Three principal streets form a triangle and at their meeting-points are placed important buildings. The layout of streets between the principal thoroughfares follows the Greek chess-board pattern with the exception of the small part of the medieval town, which has an irregularity which spoiled the classic completeness of Schaubert's scheme. Most of the important buildings erected between 1834 and 1914 were the work of German architects, a circumstance probably due to the fact that German archaeologists were more active in Greece than were those of other nations. Among the earlier buildings were the Academy, the University, and the Royal Palace, all of which were built during the eighteen-thirties. Both the Academy and the University, designed by the elder Hansen, are reproductions of Greek temples adapted for their purpose. The Royal Palace, by Gartner, is more interesting. It has a simple principal elevation with numerous square window-openings in plain walls, and a central feature with a portico of columns and pedimented top. There is little relation between the central feature and the flanking masses, but such shortcomings are somewhat mitigated by its quiet restrained character.

The National Museum, by Lange, completed in 1889, is another reminiscence of Greek temples, but the best of these public buildings which seek to revive the temple architecture of ancient Greece is the National Library, which makes a group with the older buildings of the Academy and University. The National Library was built in 1901 by Theophilus Hansen, and appears as a central temple with Doric portico and two smaller flanking temples joined by recessed masses. The flanking masses are decorated with simple pilasters. Like the Academy building the only feature which is not largely a reproduction of the work of the fifth century B.C. is the curved stairway in front of the principal entrance. The commercial buildings and houses of modern Athens, though considerably influenced by the public buildings, are designed with more freedom, and in some cases they are a frank essay in Italian Renaissance. Schliemann's House, for example, is clearly Palladian in character.[1]

As before indicated, these public buildings of modern Athens are much closer to the ancient originals than any other classical revivalist buildings in Europe. The proximity of these originals has been given as one reason, but another reason is that they are realized in the same material, namely, white Pentelican marble, while the Greek revivalist buildings of Liverpool, Berlin, and Leningrad are realized in coarser limestones and sandstones. Similarity of climate helps the impression. Another reason for their being more accurate reproductions of the proportions and details of Greek temples is, I think, the circumstance that their authors were really more archaeologists than architects. The result is that something of the purity, chasteness, and dignity has been captured. But it is a reminiscence; the buildings have a romantic quality because they are dreams of the past, but they do not belong to the urgent industrial life of modern Europe. The significance of these modern Athenian buildings for later European architecture is that they seem to have been a considerable influence in later Fascist architecture of Italy and National Socialist architecture of Germany.

The return to Renaissance work prior to the classical revival meant generally a return by many architects to various periods from the inception of the Renaissance in their country to the end of the eighteenth century.

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[1] An account of modern Athens, with several illustrations, is given by Lionel B. Budden in the *Architectural Review* for 1912, vol. xxxi, p. 315; vol. xxxii, p. 6.

The particular period selected was generally a matter of individual taste. As Renaissance was influenced in its developments by the earlier traditions of each country, and by the work of individual architects, this return meant partially a return to native traditions. For example, in England, some architects sought for models in the transition from late Gothic to Renaissance during the sixteenth century, others in the forms that lingered in domestic architecture of the seventeenth century, others in the classical domestic architecture of the eighteenth century, while others followed the work of individual Renaissance architects. It would be safe to assume, in looking at the Belfast City Hall, completed in 1906, that its architect, Sir A. Brumwell Thomas, had considerable enthusiasm for the work of Wren, as this building is very much an adaptation of St. Paul's Cathedral for the purpose of a City Hall. The dome and the four corner turrets and the principal portico are fairly close copies of these features in St. Paul's.

More interesting is the revival of early Renaissance work when it retained some of the features of Gothic. The Hôtel de Ville in Paris was built in 1871 by Ballu & Deperthes in the early Renaissance style of the former building (Plate III). Gothic characteristics in this building are seen chiefly in the stone mullions and transoms of the square-headed windows of the first story. Early Renaissance palaces and large houses are the prototypes before the full influence of classical architecture had developed. It is difficult to assess the influence of the Hôtel de Ville, but many subsequent buildings of considerable importance represent a similar revival of early Renaissance. Two prominent examples are the Palace of Peace at The Hague (Plate III), by the French architect L. M. Cordonnier, completed in 1912, and built in the style of sixteenth-century half-Gothic and half-Renaissance Dutch architecture, to which I refer again, and the Victoria and Albert Museum, at South Kensington, designed by Sir Aston Webb and completed in 1908. Although the Victoria and Albert Museum is mainly early Renaissance in style and has a symmetrical plan, with the exception of the adjustments necessitated by a corner site with two street elevations, it has several late Gothic features.[1] As in the Hôtel de Ville the rectangular windows with stone mullions and transoms are late Gothic reminiscences, while the radiating arched crowning feature above the central space has Gothic rather than Renaissance prototypes in such spires as that of St. Nicholas, Newcastle, and St. Giles, Edinburgh. The use of red brick with stone dressings at corners and round entrances and windows

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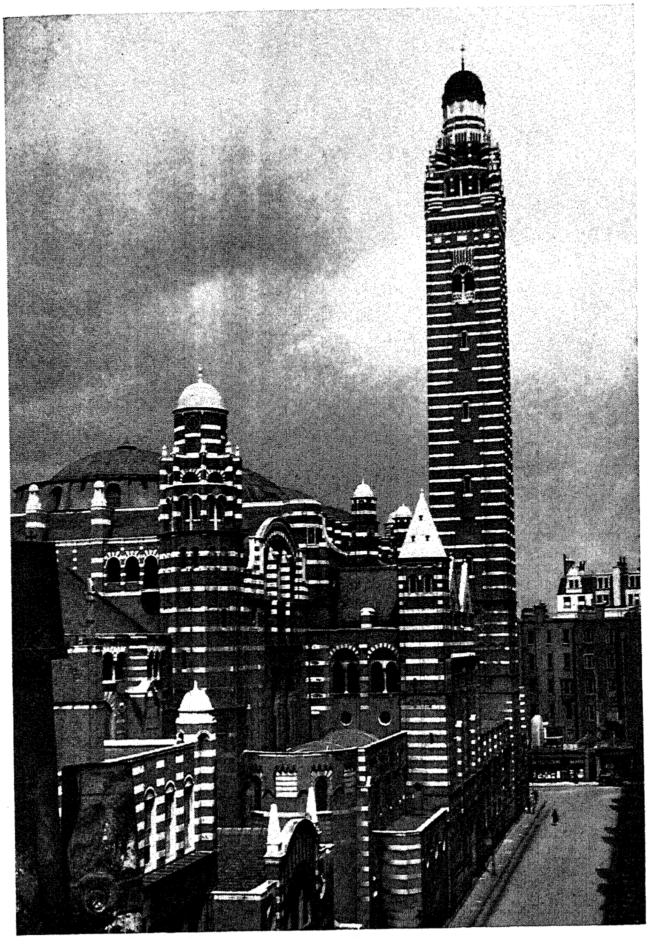
[1] Late Gothic applied to secular buildings is often called Tudor, but here all Tudor architecture is comprehended as late Gothic.



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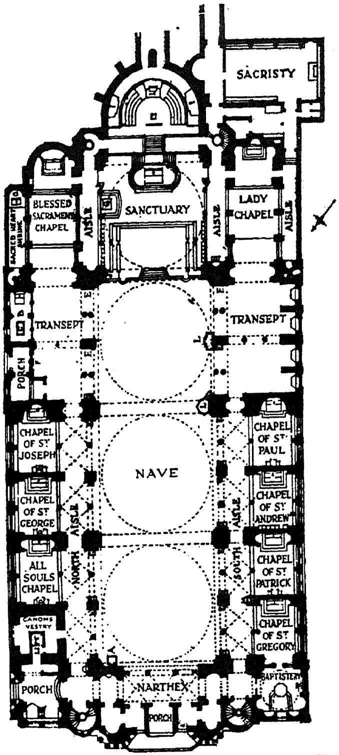

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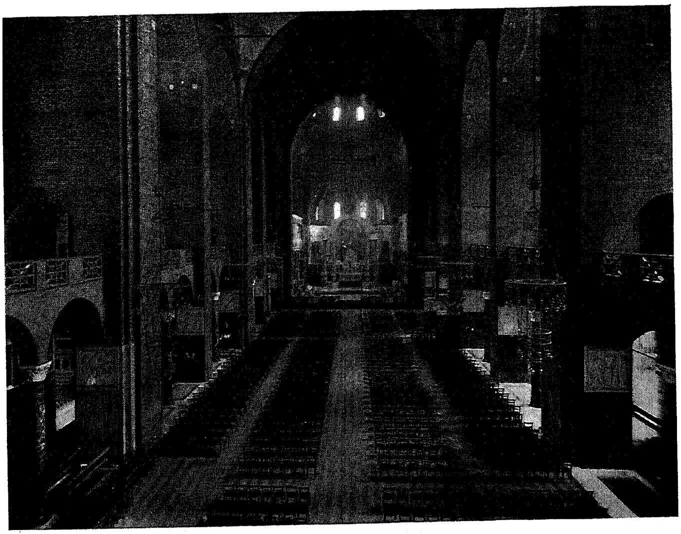


B

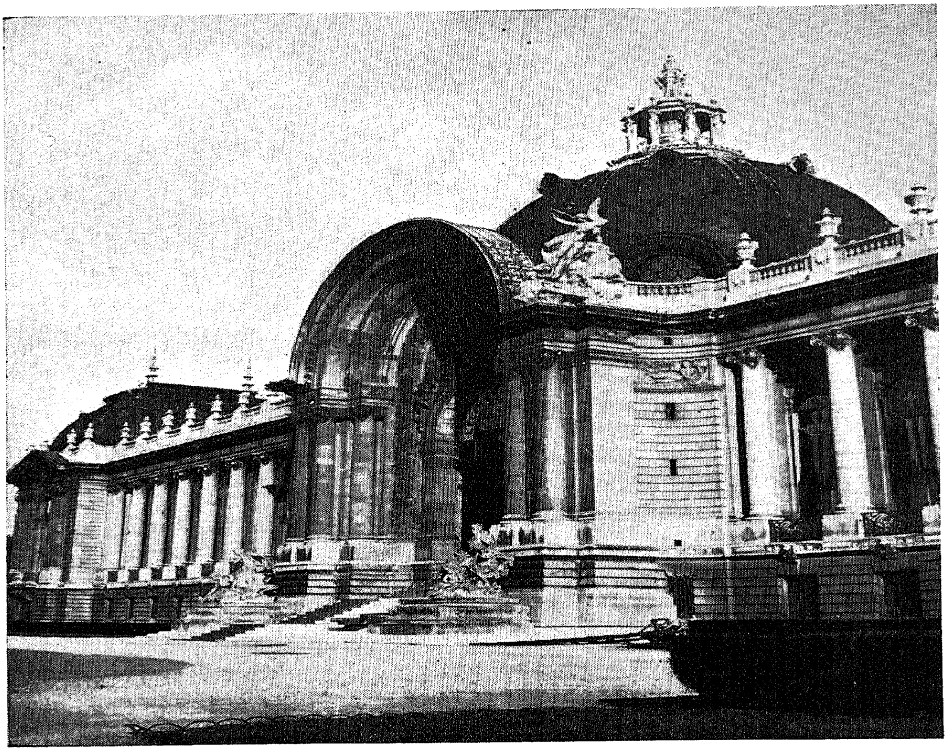
WESTMINSTER CATHEDRAL (BEGUN 1895, SHELL COMPLETED 1903)

Architect: JOHN F. BENTLEY

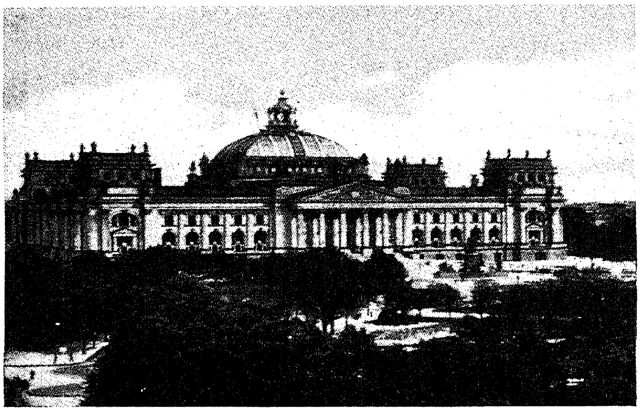
A. GENERAL VIEW OF THE EXTERIOR

B. THE INTERIOR LOOKING EAST

C. PLAN

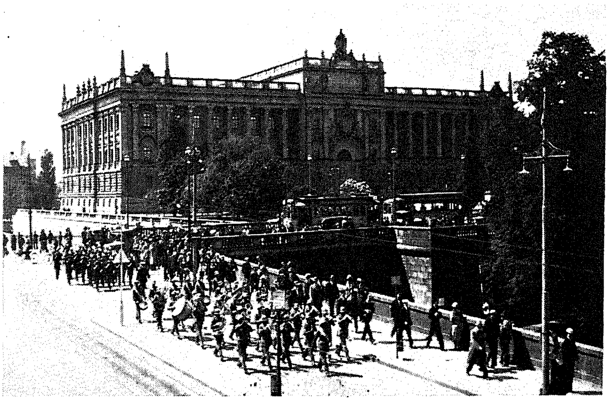


PETIT PALAIS, PARIS, BUILT 1900
Architect: CHARLE GIRAULT

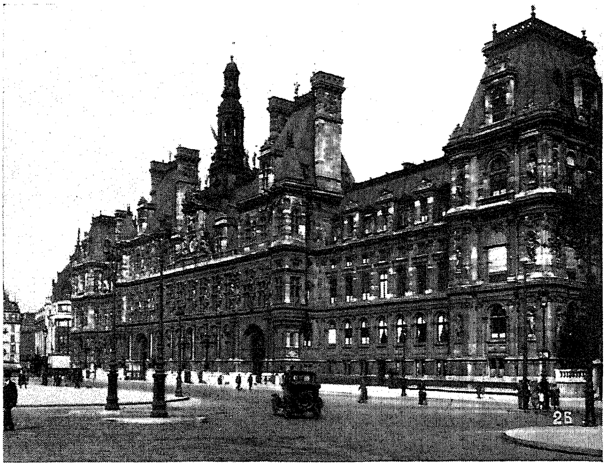


REICHSTAG BUILDING, BERLIN (1890)
Architect: PAUL WALLOT

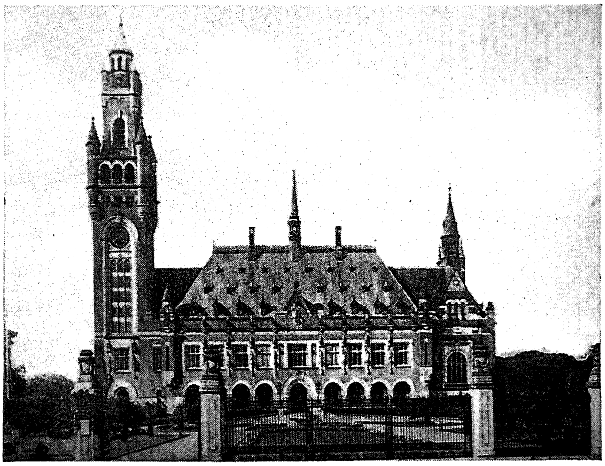
PLATE II



HOUSES OF PARLIAMENT, STOCKHOLM (COMPLETED 1905)
Architect: ARON JOHANSSON

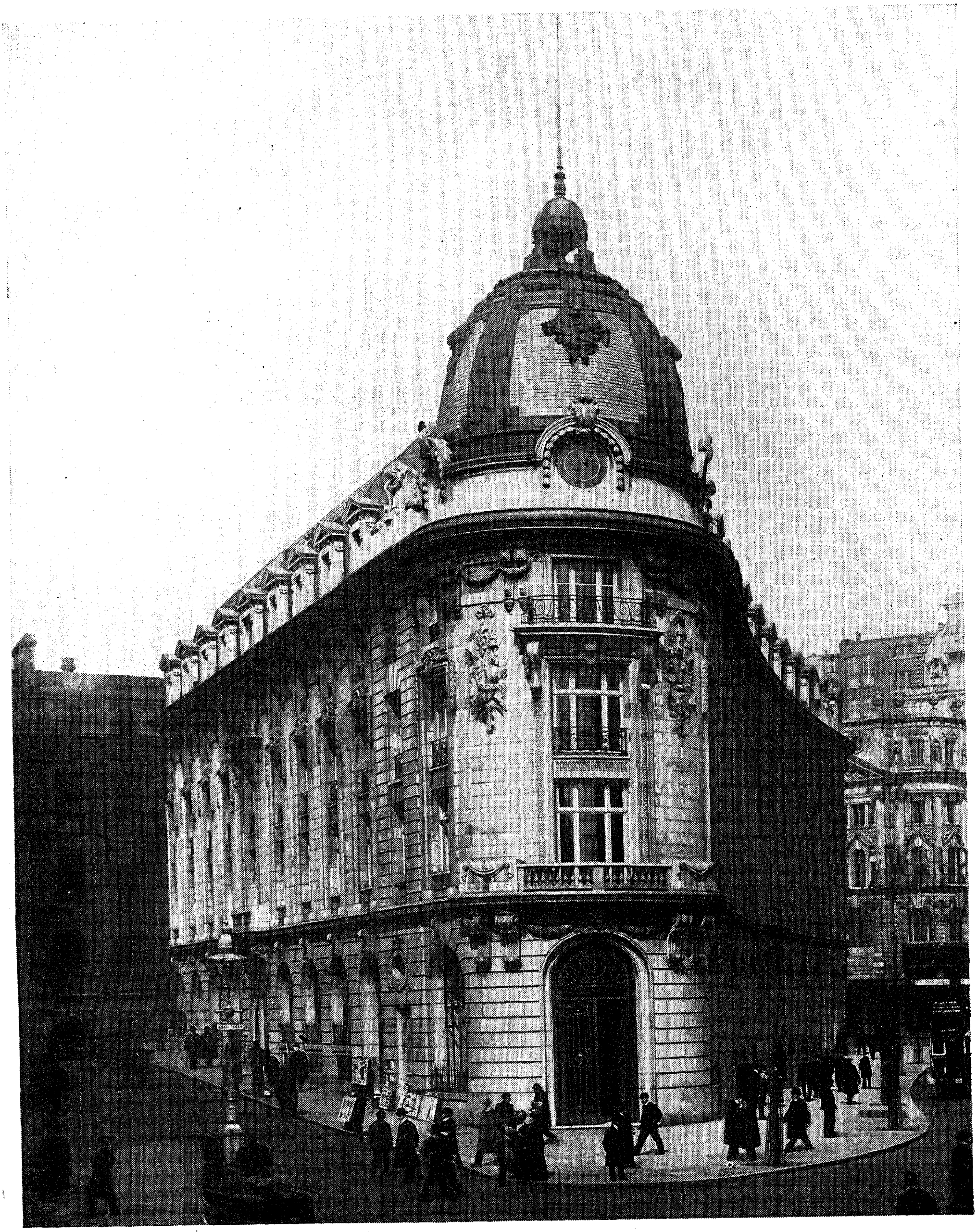


HÔTEL DE VILLE, PARIS (1871)
Architects: BALLU AND DEPERTHES



PALACE OF PEACE, THE HAGUE (1913)
Architect: L. M. CORDONNIER

PLATE III



THE 'MORNING POST' BUILDING, WELLINGTON STREET, LONDON (1906)

Architects: MEWÈS AND DAVIS

The illustration shows the building as originally completed and before additions were made to it by later owners. One of the first steel frame structures in London, its façade is in granite

PLATE IV

is a revival of English Renaissance under Dutch influence at the time of William and Mary. In modern Renaissance it was employed by Norman Shaw, and it has since become popular with many English architects.

Archaeologists during the nineteenth century greatly extended the field of history, revealing to us the remains of ancient civilizations. Before the nineteenth century very little of the actual remains of Egyptian, Assyrian, Babylonian, and early Greek art was known. Most educated people had a vague impression of ancient Egyptian civilization and art, and an even more vague impression of ancient Assyrian, Babylonian, and pre-classical Greek art and civilization. It was not until the systematic exploration of Egypt begun by Richard Lepsius following the preparatory work done by F. Champollion in 1826, of ancient Babylonia and Assyria by M. Botta and Sir Henry Layard in the eighteen-forties, and the work in Greece begun by Schliemann in about 1870, that the art of Egypt, Assyria, and pre-classical Greece became at all familiar. At the same time archaeological work in other fields progressed. Also the introduction of speedier travel by the advent of railways helped to familiarize the products of ancient cultures in different parts of the world. All this had its effect on architecture, and architects of the early twentieth century, in their restless striving for originality and search for fresh decorative motifs, introduced ornament from the architecture and art of ancient Egypt, Assyria, Persia, and other ancient civilizations. Although mostly confined to the introduction of decorative motifs so that one might say that a building has a slightly Egyptian or Assyrian or Persian character some architects designed buildings completely in the Egyptian style. It is unnecessary to dwell on this work, for any architectural merit such buildings may have is not connected with revivals of remote decorative embellishments. It is interesting to note, however, that where these archaeological revelations have borne little fruit in contemporary architectural practice, it had a most salutory influence on modern sculpture, helping to free it from the tyranny of the classical tradition.

The best notion of the character of European architectural design, representing at least 95 per cent. of work in the ten years preceding the First World War, is, I think, afforded by the designs submitted at the international competition for building the Palace of Peace at the Hague. A small minority were the pioneers and progressive architects, who were striving to make architecture a living thing growing out of contemporary life. These will claim far more of our attention later.

Mr. Andrew Carnegie allocated 1½ million dollars to the Dutch Government for a building for an International Court of Arbitration and for a library in connexion therewith, the two to form a Palace of Peace. An international competition for the design of the building was held and certain famous architects were specially invited to compete. In April 1906, 216 designs were submitted. Six prizes were offered and these in order were won by L. M. Cordonnier of Lille, A. Marcel of Paris, F. Wendt of Charlottenburg, Otto Wagner of Vienna, H. Greenley and H. S. Olin of New York, and F. Schwechter of Berlin. The plans of the six premiated designs and the forty other designs chosen for publication by the Society of Architecture at Amsterdam are symmetrical, with the single exception of F. Schwechter's, in which at the rear there is a non-symmetrical note. But here the general similarity of the designs end. What is remarkable is the great diversity of treatment, plans, and styles, yet very few of the designs viewed in the retrospect of forty years can be regarded as of great merit. The site being an open one and the planning offering no very difficult problem—merely the alternative of combining the court and library in one block or separating them, all the designs showing one of these alternatives—architectural skill and originality centred chiefly in the style of the building. Generally, expression of purpose was lost in the all-powerful habit of designing in some style of the past. There is one point of special interest, however, in the designs. It would not be difficult for one familiar with European architecture to tell in looking through the forty-six designs from which countries many of them emanated, and many seem, in a curiously revealing way, to express national characteristics. Cordonnier's project, placed first, was designed in accordance with the traditional local architecture of the sixteenth century, and this circumstance influenced the judges. The design appears now as an ornate revival of the architecture of transition from Gothic to Renaissance with Romanesque elements mixed in. It was modified in the actual building completed in 1913, becoming simpler. A. Marcel's design, placed second, was so close a copy of Girault's Petit Palais that it is a wonder that the judges did not rule it out on the ground of lack of originality. It is interesting to contrast with this the two German designs placed third and sixth. Both are designed in the classical Renaissance style, but with a heavy, massive treatment which is so marked a character of later German Renaissance work.

Two of the most original designs were submitted by Otto Wagner and H. P. Berlage. Both have an eclectic tendency, both abandon the excessive emphasis on the main entrance. Neither is equal to the best of their architect's earlier work. Berlage's design has a flat central dome and a campanile is introduced, the whole betraying Byzantine influence, but, what is important, it shows a tendency towards the use of simpler unornamented masses which characterizes Berlage's Amsterdam Exchange building, to which I will refer later.

Two designs submitted by two architects from Helsingfors show a refreshing simplicity. One by E. Saarinen employs Egyptian decorative features, while the other design, by Jarl Eklund, is a simple treatment of Romanesque. Carl Hocheder, a Munich architect, showed a design with very strong Baroque influence. J. Ping Cadafalch's (Barcelona) design is an adaptation of Spanish Gothic; Smits and Fel's (The Hague) is another simple version of Romanesque, while Valenten Vanerwyck's (Ghent) contribution is designed in the late Flemish Gothic style. It will be seen from these notes that the influence of native traditions on architects is partially responsible for the expression of national characteristics in these designs. The Italian contribution from Guiseppe G. Mancini of Rome is somewhat amusing in this respect. It is the most grandiose design of the collection, and it is an expression in architecture of bombast and pomposity. If one wanted an expression of Mussolini in architecture, here it is.

The designs submitted by English architects show little originality and are strongly reminiscent of prominent London buildings. Jan F. Groll's design is a mixture of the Natural History Museum and the Imperial Institute, the designer bearing in mind, perhaps, that the architect of the latter building was one of the assessors. Henry T. Hare's design suggests the Wesleyan Hall at Westminster, although it is too early to be a copy, while J. Coates Carter's design is an eclectic work very much influenced by Norman Shaw. Among the best designs submitted were those in the classical style, two being from Eduard Cuypers of Amsterdam and Henri Eustache of Paris. The former is simple, massive, with large windows and a central dome; the latter is a restrained, dignified classic design with a felicitously proportioned central portico of Corinthian columns. It is the most Greek in feeling of all the designs. Many of the other projects submitted show a mixture of various styles—Egyptian, Greek, Assyrian, Romanesque, Byzantine, Saracenic—often extravagant and bizarre and having very little relation to the purpose of the building. Such, roughly, was the state of architectural design as practised by the majority of well-known architects in Europe in the years preceding the First World War.

CHAPTER III

Eclecticism

MENTION has been made of the restlessness of architects during the late nineteenth century arising from the dissatisfaction with merely imitating past styles. Prompted to search for something that would lead them to create a style more expressive of contemporary life or, at least, to the creation of a more original architecture, some architects tried to achieve that originality by blending historical styles and thus becoming eclectics. This blending was generally most successful when one style dominated, or when the whole building was of restrained character. The Imperial Institute at South Kensington, built in 1887 to the design of T. E. Collcutt, is an example of a mixture of Romanesque, Gothic, Byzantine, and Renaissance motifs, with the first most pronounced, but all unobtrusive because ornament is kept flat and restrained. But where there is not this restraint, as in that earlier curious eclectic work, Sir Gilbert Scott's Albert Memorial (1861–4), supposed to be derived from a thirteenth-century reliquary, but which is an obtrusive mixture of classical, Gothic, Byzantine, and Baroque styles involving an incongruous mixture of materials, then the result is apt to be ugly.

A typical architect of the last quarter of the nineteenth century was Richard Norman Shaw. His earlier work, which is by far the most important, and with which I will deal in the next chapter, is of a functional character emerging from Gothic, but he moves from this promising start to eclecticism and later still to classicism. Norman Shaw was greatly enamoured of the picturesque, which gave a florid character to many of the eclectic works of his middle period, works like New Zealand Chambers in Leadenhall Street (1872), Albert Hall Mansions (1879), the first Alliance Assurance Building, Pall Mall (1882), where Romanesque, Renaissance, and Gothic motifs are freely mixed. The New Scotland Yard building (1888), regarded by many as his masterpiece, is an original mixture of Gothic and Renaissance elements, dominated by the picturesque effects such as the corner turrets. In many houses built between 1870 and 1890, of which 'Pierrepoint' at Farnham in Surrey (1876) is an example, there is a profuse use of half-timber work as decoration, and he, more than any architect, is responsible for the craze for sham half-timber effects which characterize so much English housing of the present century. Later still, Shaw renounced his earlier romantic tendencies, and became another architect of the classical Renaissance tradition in many of his later country houses, in the second Alliance Assurance building, St. James' Street (1903), and in the Piccadilly Hotel (1905).

In most European countries during the last years of the nineteenth century and early years of the twentieth, buildings were erected of an eclectic character. Many of the town-halls built in the vicinity of Paris and in English and German provincial cities were of this kind. Some, like the Hôtel-de-Ville in Paris, noted in the last chapter, are more accurately described as a revival of early Renaissance where many Gothic elements were mixed with the Renaissance importation, while others are more clearly blendings of distinct styles, with Romanesque often prominent. It cannot be said that any of the eclectic buildings so far mentioned are of great architectural value. Although the Scotland Yard building has been much praised, Sir Reginald Blomfield referring to it as 'the finest public building erected in London since Somerset House',[1] it seems to me incongruous, unsuitable in design, and of little beauty. This is, after all, a central police administrative office, and yet Shaw gives it a suggestion of a medieval castle. The corner turrets which help to convey this are prominent features but hardly grow out of the purpose of the building, and are really little better than large stuck-on ornamental features. There is, too, an incongruous effect in the large stone ornamental Renaissance features perched high up at the roof gables, for they have little relation to the general design of the building, and appear merely as inharmonious applied ornament. It is one of the consequences of an insufficiently digested eclecticism.

Eclectic is a term derived from the Greek, originally applied to philosophers who borrowed from many schools of thought. The term has been used extensively in art criticism in modern times to apply to an artist who selects features from many schools and styles and blends them. It is often used in a derogatory sense of an artist who does little more than that, but is generally charitably withheld from an artist who so blends what he selects from various schools and styles that he forms a fresh and original creation. There are some who would still speak of such artists as eclectics, if the various sources of their art can be seen in different schools. Thus Raphael and Augustus John, although both original artists who have made important contributions to the art of painting, are sometimes called eclectics, because elements in their work are traceable to many different sources. Motifs from other artists' work are clearly recognizable, but they form parts of something entirely new. It is thus possible to speak of eclecticism in a disparaging sense where the elements are not blended to make any new and original work, but merely give an impression of piecing together or of a not very well-mixed hash; yet at the same time it is legitimate to speak of eclecticism in a better sense, where though motifs have been selected from different sources, their essential character has been absorbed by the artist, and they have been welded together to produce something entirely new and beautiful. It is in this latter sense that I think of Liverpool Cathedral, by Sir Giles Gilbert Scott, as eclectic. Here is an eclecticism of a deeper and more serious kind than any to which reference has so far been made. As it is one of the greatest buildings of the twentieth century it merits some detailed consideration. Although it is still unfinished —the nave has yet to be built—it is essentially a conception of the early years of the century, before the First World War. Historical sequence suggests, therefore, that it should be considered here.

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[1] Sir Reginald Blomfield, *Richard Norman Shaw* (London, 1940), p. 58.

Most churches built during the Victorian Age were built in the revived Gothic style. The work varied according to the preferences of the architects, and it is not difficult to distinguish the work of one architect from another. Of the architects principally responsible for Victorian churches—Pugin, Butterfield, Scott, Pearson, Street, Bodley, Sedding, and a few others—some, like Pearson, seemed to favour one particular phase of Gothic; some, like Pugin and Butterfield, were more interested in Gothic construction than design; while others, like Scott and Bodley, versatile with their copy-books, would pass from one Gothic style to another at the wish of their clients, or according to the known taste of competition assessors. Pearson, who was one of the most original of Victorian architects within the confined limits of revivalism, introduced a new note in using brick for the exterior of churches in the Early English or Decorated style. These brick exteriors often have a breadth, simplicity, and dignity which is impressive, a good example being St. John's Church, Upper Norwood, with its large, plain wall-surfaces. Such examples may have contributed to the use of brick in large, plain surfaces which is a feature of much modern church architecture.

Most Victorian church architecture follows Gothic fairly closely, with minor notes of original treatment. Liverpool Cathedral represents a refreshing and original departure from Victorian custom with a totally new conception.

The See of Liverpool was formed in 1878, and in 1885 powers were obtained to build a cathedral. An eclectic design, by Sir William Emerson, partly Gothic, partly Renaissance, with a dome, was approved. This project was abandoned. The matter was revived in 1900, and after some controversy the site of a disused quarry near an old cemetery on St. James's Mount was chosen. The choice was admirable because, being on ground well above the level of the city, the cathedral would have an elevated and dominating position which would allow it to be seen from miles around, from the country-side, and from ships approaching the river and harbour from the sea.

The selection of Giles G. Scott as the architect in 1903—he was then only 23 years of age—was the result of a competition[1] in which G. F. Bodley and Norman Shaw were assessors. In their recommendation they referred to Scott's design as having 'that power combined with beauty which makes a great and noble building'. The cathedral committee were a little apprehensive about appointing so young a man, inevitably with so little experience in directing building operations, so G. F. Bodley was appointed joint architect with Scott. Bodley died, however, in 1907, and Scott henceforth carried out his own design alone.

The earliest part of the cathedral to be completed was the Lady Chapel, which was consecrated in 1910. It is the part of the cathedral which is the closest to traditional Gothic, having here and there, especially in the roof and windows, the character of work of the Decorated period. This was, I suspect, partly due to Bodley's influence. The reredos, for example, was the joint design of the two architects. The Lady Chapel has, however, much that is original. The proportion of low arcade and high clerestory, double the height of the arcade, is unusual, and gives a massiveness to the lower part. The upper part is, like traditional Gothic, essentially a design in line emphasized by decorative ribbed vaulting, and in this it differs from the later work in the cathedral where linear motifs are more restrained and subordinated to mass effects.

After Bodley's death Scott became more and more dissatisfied with his original design. This had consisted of a cruciform plan with single transepts and twin towers over the transepts. The nave was longer than the choir, and each was broken by a series of cross-bays which were to be lit by tall lancet windows. The Lady Chapel was at the east end (the liturgical east, as the cathedral, owing to exigencies of site, is orientated more nearly south and north, the south forming the liturgical east), with a square chapter house to the north. In 1910 a new plan was adopted, and this is the plan

[1] Particulars of this competition are given in the *Official Handbook of Liverpool Cathedral*, by Vere E. Cotton (ninth ed., 1936, pp. 10 and 11).

of the cathedral as it is built. This consists of four transepts on either side of a central space above which rises a single central tower. The choir and nave are made of equal length, and the chapter house is altered from a rectangle to an octagon and reduced in size. (Plates V–VIII).

The cathedral is built mainly of red sandstone from the Woolton quarries, a few miles away, with a certain amount from the Rainhill and Runcorn quarries for the interior. The foundations are of brick and concrete, and the outer roofs above the stone vaulting of the choir and transepts are of reinforced concrete. The main floor consists of tiling on concrete slabs laid on reinforced concrete beams, some of which are hollow for the circulation of warm air; for in heating the cathedral the method of the Romans of circulating hot air under the floor is employed. Additional heating is supplied by radiators placed under the windows.

When finished it will be the largest cathedral in England, although the new Roman Catholic Cathedral when completed will be larger still. It will have a total area of 100,000 square feet, which compares with 227,000 of St. Peter's at Rome, 59,700 of St. Paul's, 63,800 of York Minster, 107,000 of Milan, 128,500 of Seville, and 109,000 of New York.

Although designed with Gothic calligraphy, it is a building which departs considerably from traditional Gothic, acquiring a character which links it with the classical tradition. It is as if the spirit of Gothic architecture had extended its hand backward in time to grasp that of classical architecture, and it is therefore inevitable that it has a little of the character of the actual intervening Romanesque work. This is seen particularly in a modification of the Gothic framed structure and the use of a massive wall-structure. Instead of a light stone frame and flying buttresses to take the thrust of the vaulted roof, there are massive, solid, pier-like buttresses, through which the aisles have the effect of being tunnelled; and the rounded pointed windows suggest a movement from Gothic to Romanesque, as if they were half inclined to become completely semicircular again. This contributes to a structure which has a massiveness and grandeur, a breadth and repose combined with a spirit of aspiration which is unique, and this combination is the result of blending Gothic linear design with classical mass and breadth. The plan is based on classic symmetry with transepts, choir, and nave all equally balanced on either side of the central space, and the massive square central tower, with the four rectangular blocks of transepts buttressing it, is essentially classical in conception.

Massiveness, dignity, power are the dominating qualities of the exterior, but the interior is even more impressive. Here breadth of design is eloquent in the large bare wall-spaces of the lovely pale crimson sandstone patterned with wide white joints, while the piers ascend without a break to the springing of the arch which reaches in the shadows of the vaulted roof to a height of 116 feet in the choir and transepts,[1] and 176 feet in the central space. The choir span is 61 feet, thus narrow in proportion to height, a circumstance which enhances the spirit of aspiration, enhanced also by the fading of forms in the shadows of the vaulted roof, as a sense of mystery is thereby created. When standing in the central space and looking towards the choir, one has the impression of architectural magnificence and perfection, an experience that comes not often in life. It is only when one looks from the choir to the central space that a note of criticism is prompted by the relation of the arch of the central space and the arch of the choir. It seems that the former does not curve in harmony with the latter, the span is relatively too wide. If the same proportioned arch had been employed for the opening to the central space I think the effect would have been better.

The cathedral is eclectic in the best sense, and in being so is expressive of the age which produced it, as it represents the meeting and intermingling of two great traditions when the moment of such confluence is possible. In another, different, sense it is expressive of its age. It is full of beautiful details, of lovely, precise, carved ornament in such central features as altars; but these are produced very differently from the ornament of a medieval cathedral, when much was left to the individual freedom and taste of each carver, so that carving in medieval churches is conspicuous for its variety. In Liverpool Cathedral all details are conceived and precisely defined by the architect, and the carver follows closely the mind of the architect. Thus the whole work to the smallest detail is completely the product of one mind. This control by one mind, this adherence to the precise formulations of the designer, belongs more naturally to a machine age than to free medieval craftsmanship. It is thus in this sense expressive of its time.

What is the essential life and spirit behind this meeting of two traditions, this attempted blending of the breadth and repose of a Greek temple with the aspiring character of a Gothic cathedral? The emphasis of vertical lines, which conduces so much to the spirit of aspiration, is eloquent in the long vertical interior piers running into the pointed arches of the vaulted roof; yet a feeling of repose is blended with that impression by the introduction of large, unbroken, rectangular spaces, and horizontal lines and forms emphasized here and there. The energy and somewhat restless character of many a Gothic cathedral is thus modified. Sir Giles G. Scott himself says[1] that 'in most Gothic cathedrals the emphasis of the vertical is unduly stressed and thereby a great deal of calm and serenity is sacrificed', and there is a 'feeling of restlessness which tends to destroy repose and peace'. And further, 'it comes to a question of balance, like everything in nature, and at Liverpool I have endeavoured to combine the uplifting character imparted by vertical expression with the restful calm undoubtedly given by judicious use of horizontals'. And so 'subsequent alterations that have taken place have all been with a view to reducing the vertical character, and thereby emphasizing the influence of the horizontals'. We shall see later how this tendency of blending the breadth and repose of Greek architecture with the aspiration and energy of Gothic is a characteristic of Sir Giles Scott's later work and of much other modern church-designing, probably due partly to his influence.

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[1] An idea of this height may be obtained from comparing it with the two highest English medieval interiors: Westminster Abbey which is 101 feet, and York Minster which is 99 feet.

The monolithic character of the Greek temple enshrining the god within expresses the spirit of resignation—to fate, to death as final and irrevocable. The mystic *cultus* known as Orphism that Polygnotus seems to have expressed in the Lesche paintings so minutely described by Pausanias; the vague notions of a beautiful land in the West and of Hades, derived from Homer; and the theories of Platonists were but the religious speculations of fanciful minds. In spite of these, the religious feeling of the average educated Greek was that of resignation to the thought that death is the end. It is revealed consistently in the sad farewell scenes on the Greek stelae of the fifth and fourth centuries—a source of information telling of the feelings of the Greek people far more reliable than the fancies of theorists, or the entertaining speculations of philosophers. Did not Pindar say 'desire not a life immortal, but use to the utmost the tools that are in thine hand'? And similar is the sentiment that pervades the famous funeral oration of Pericles, who ruled in Athens when its greatest architectural glories arose. This resignation emanates partly from the Greek worship of reason, and hence a rationalism, a philosophical acceptance of the inevitable which gives to their creations a serenity and repose, tinged here and there with a beautiful melancholy.

A Gothic cathedral energetically struggles to be free from all such resignation. Here is the restless striving towards heaven, the fervent worship of the God in heaven that, to the medieval mind, existed somewhere above in the ethereal blue. Pillars within stretching in long vertical lines to the pointed arches and vaulted roofs, and towers and steeples without soaring upwards to the sky, all express in unison fervent worship and heavenly aspiration. As Goethe says: 'The steeples are not like cupolas, to form a heaven within, but strive towards heaven without.' And what was this present life to the Christian, contemporary with the raising of these cathedrals, but a preparation for the next? His life was a constant worship and glorification of God, a constant aspiration to be worthy of the richer and greater life to come, and he expressed this spirit in his places of worship.

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[1] In an article written in the *Morning Post* on the day of the consecration of the choir, 19 July 1924.

Two more complete contrasts of form and spirit can scarcely be imagined. Yet the Renaissance was in many ways the intermingling of Christianity with Greek culture. Those eager thinkers of the fifteenth century feverishly endeavoured to reconcile forces that to them appeared almost irreconcilable. A great civilization, often profound, idealistic, and noble in its thought, existed before Christ was known, not as the herald of Christ, but in many important ways distinctly different from the things that Christ taught. And so many, like Pico della Mirandola, embraced the most Christian-like of the Greeks, like Plato, as the chief ray of hope in their attempted reconciliations, but ultimately gave up the task in despair. These eager minds are of value to-day chiefly as throwing light on one of the most interesting periods in the development of thought. The reconciliation that they attempted was destined to lead to something else. Greek religious thought and Christianity have never been reconciled, but they have intermingled and the modern world is the richer for it. The passing years have shown that by taking the best of Christianity and the best of Greek culture we achieve a bigger, fuller life than each can give us separately. The modern world dates from the Renaissance, a movement not yet completed, for that intermingling of the two chief sources of spiritual and intellectual life is constantly going on and fresh contributions are made every year. Much in the older Christian doctrines is now rejected as gross superstition, much of the fervid Christian sentimentalism is dissolved by a reason inherited from the Greeks, much medieval bigoted and philistine morality, which had a late outburst in the Puritans, has been rationalized by the Greek love of beauty; while strains of brutality and harshness in Greek life have been softened by Christian kindliness; and the sentiment of love grows to greater magnitude than hitherto with the advent of Christian belief and thought. It is not too fanciful to carry the notion to architecture and see in Liverpool Cathedral, and buildings in a kindred style, an expression of the blending of these two cultural forces in our lives. In sharing the spirit of such work we are but children of a Renaissance which represents the marriage of Greek culture and Christianity.

One thinks of Bach's organ music as most fittingly heard in a Gothic cathedral with the music soaring upwards with the long vertical piers, and reverberating among the vaulted roofs. Yet however much one feels of the Christian spirit in Bach's music, however much it suggests Fra Angelico's choirs of angels echoing through Gothic churches, his music is essentially classical in form, and like Liverpool Cathedral, it seems to blend the spirit of classical beauty of form with Christian aspiration. In Liverpool Cathedral Bach's music has a setting which is the creation of the same spirit, and to absorb them together, through the medium of the magnificent cathedral organ, is one of the rare experiences of life.

CHAPTER IV

Romanticism, Utility, and the Search for a Living Architecture

EARLY in the nineteenth century a few noteworthy architects expressed vague dissatisfaction with designing in the styles of past civilizations, and asked why an architecture expressive of contemporary life could not be evolved. About 1830 Schinkel came to England and visited Manchester and the growing industries of the north. He felt that the revived Greek architecture, some of the finest examples of which he was the author, was completely out of touch with this growing industrial life, and he wrote in his diary: 'All great ages have left a record of themselves in their style of building. Why should we not try to find a style for ourselves?'[1] Still, Schinkel continued to design fairly closely to Greek models, yet with a sensitive feeling for proportion which proclaimed him an artist of rare distinction. He had made one attempt earlier, in 1820, towards a more expressive architecture, in the design of a departmental store,[2] which shows very large windows with pilasters between, making façades somewhat like the grid-iron steel-frame façades of the twentieth century. It is a remarkable forecast of things to come.

Henri Labrouste designed the Library of Sainte-Geneviève in Paris (1843–50), and the Bibliothèque Nationale in Paris (1858–68). They both have restrained exteriors of classical design, the former with symmetrical plan, but the latter with a plan which, though influenced by classical formalism, has a certain irregularity determined by considerations of convenience and function. The iron and glass construction of the interiors are of value in such developments, and will be considered in a later chapter. Labrouste's conception of architectural practice was not that of his contemporaries: of designing in a style and beginning with a fair appearance and trying to make fulfilment of purpose conform to these; on the contrary it was that of designing for purpose with appearance conforming to such designing. Much earlier, in a letter written to his brother in 1830 regarding instruction of pupils in his *atelier*, he says: 'I tell them that they must derive from the construction itself an ornamentation which is reasoned and expressive. I often repeat to them that the arts have the power of making everything beautiful, but I insist that they understand that in architecture form must always be appropriate to the function for which it is intended.'[1] These principles seem to have determined the progress in functional planning made by Labrouste from the Library of Sainte-Geneviève to the Bibliothèque Nationale. It is in the thought of Schinkel and Labrouste, as early as 1830, that we find the first seeds of the new architecture, that were to grow so exclusively and slowly in England during the last forty years of the nineteenth century, to struggle more vigorously and widely in Germany, Austria, Holland, Belgium, and France in the early years of the twentieth century, and to blossom in the period between the two great wars. Labrouste's pronouncement in 1830 that 'in architecture form must always be appropriate to the function for which it is intended' represented one of the earliest conscious recognitions of the conditions of a living architecture, and an anticipation of modern doctrine.

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[1] Quoted by Walter Curt Behrendt in *Modern Building* (London, 1937), p. 39.

[2] Reproduced in Bruno Taut's *Modern Architecture* (London, 1929), p. 35.

Schinkel might have seen the basis of a living style, about which he asked, in some of the factories and warehouses of that industrial England which prompted the question. These buildings were designed solely for utility; appearance and style were not considered, and it is improbable that architects designed them. The best are probably the work of engineers, and many were probably designed as the result of consultations between the factory and warehouse owners and the building contractors. We know that Telford designed several, one being the warehouse at St. Katherine's Docks in London. Other early industrial buildings, noteworthy for good, straightforward, and efficient design, are the Francis Hill factory at Malmesbury, built in 1790; Bentley's piano factory in the Stroud Valley, built a little later; and Stanley Mill in the Stroud Valley, built in 1813 (Plate X). All these buildings are well lighted, having large horizontal windows, while cast iron is used for interior columnar supports in many of them. Although strictly utilitarian the plain walls, well-proportioned windows, and general, simple, efficient character make the best examples far more expressive of the life of the time than modern commercial buildings dressed as Greek temples or medieval monasteries.

The railway station offered a new type of building, and, apart from the stylistic hotel buildings that formed the frontages of large termini, it was generally designed on utilitarian principles. The roofs are often interesting as constructions, and also sometimes succeed in being works of art. The concentration on utility, and the consideration afterwards of appearance growing out of function, has resulted in some beautiful and noteworthy examples, like the station at Frankfurt (1868), the Gare du Nord in Paris (1862), and, finest of all, King's Cross Station, designed by Lewis Cubitt in 1852 (Plate X). It is a building growing out of purpose, and logically and beautifully expressing that purpose. Two semicircular arched roofs of glass and iron (originally wood) extending the whole length of the platforms are supported in the centre by columns connected by a series of well-proportioned arches. These arches are repeated on the arrival platform side, beyond which is an arched road for traffic, well placed, but effectively subordinated. Offices, waiting-rooms, and restaurants are arranged along the departure platform. Here is the perfect arrangement for a railway terminus, and it provides a splendid basis for the architectural unity of the station. The two circular roofs are felicitously proportioned and related to each other, while the long vistas with the articulation of the arcade arches between afford an aesthetic pleasure akin to that yielded by the nave of a Romanesque cathedral. The exterior façade is simple and austere, and is almost a perfect example of the exterior expressing the interior shape and purpose.

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[1] Souvenirs d'Henri Labrouste. Notes recueillies et classées par ses enfants (Paris, 1928, privately printed), p. 24, quoted in Siegfried Giedion's *Space, Time and Architecture* (Cambridge, U.S.A., 1941), p. 154.

If factories and warehouses built during the years of the Industrial Revolution had sometimes claim to architectural distinction, the same cannot be said of industrial housing, which was mean, squalid, unhealthy, and miserable in the extreme, too mean to be regarded as utilitarian. Resulting bad health and a high death-rate prompted Government legislation. Improvements were slowly effected, but the early bad industrial housing remained because the supply of houses has never reached the demand. Improved housing in the nineteenth century was very slowly effected, mainly, in the first instances, by the enterprises of companies like Krupps at Essen, and Cadbury's at Bourneville, but I will deal with these in a later chapter. We had, generally, to wait a long time, until after the turn of the century, before housing for the people, that is, low-cost housing on an extensive scale, reached such a quality that it was of a sufficiently good standard of planning and appearance even to be considered as architecture. It is in the houses of the well-to-do in England that some of the most progressive and distinctive architecture of the late nineteenth century is found.

Designing more in accordance with purpose and structure which resulted in these houses and which led to a more vital and living architecture arose to some extent from the Romantic movement. It has been said (Chapter I) that the Romantic movement arose partially as a revolt against supposed cold and scholarly classical art, but it is something deeper than that. The essence of the romantic feeling is a yearning for that which is remote, and it is often prompted by a dissatisfaction with the present, a distaste for surrounding life, and this is expressed by a desire to get away to something more congenial. Goethe's *Sorrows of Werther*, an early work of the Romantic movement, expresses the restlessness and dissatisfaction of many young men with life as they knew it, and the suicide of Werther is not merely a fiction, but symptomatic of the epidemic of suicides in Germany at the time. Goethe records in his autobiography how he, himself, toyed with the idea of suicide. Charlotte is very much a symbol of the remote and unobtainable.

Wordsworth, another significant figure of the Romantic movement, expresses so often the flight from the world about him and seeks refuge in the past or in the quiet woods and fields. 'The world is too much with us', he exclaims, and concludes this famous sonnet by asking for 'Glimpses that would make me less forlorn'. And the whole romantic urge of Shelley, Coleridge, Keats, was stimulated by the growing commercial and industrial life with its ugly living conditions of the workers. We know the passionate protests of Shelley. W. R. Lethaby remarks 'that it was probably a manifestation of a protective instinct mysteriously aware of what was to happen in the coming age'. 'Wordsworth', he adds, 'seems first to have seen things in the new way.'[1]

This developing industrial life, carrying with it so much that was distasteful to idealistic thought, inevitably stimulated a looking back and an attempt to revive the happier ages of the past, and thus it greatly stimulated the Gothic revival. The finer aspect of this revival was the romanticism that resulted in the domestic architecture in Germany of Ludwig Persius, and that in England of Philip Webb, Norman Shaw, C. F. A. Voysey, and their followers.

Ludwig Persius was a pupil of Schinkel, and in designing houses, many of which are in Potsdam and the vicinity, he followed rather the medieval work than the classic work of his master,[2] and made his plans more in accordance with convenience and purpose, while he orientated them not as an abstract geometric layout, but in accordance with the sun and the character of the ground. He related his houses to their garden setting, and comprehended both as a unity, thus being somewhat of a forerunner of the

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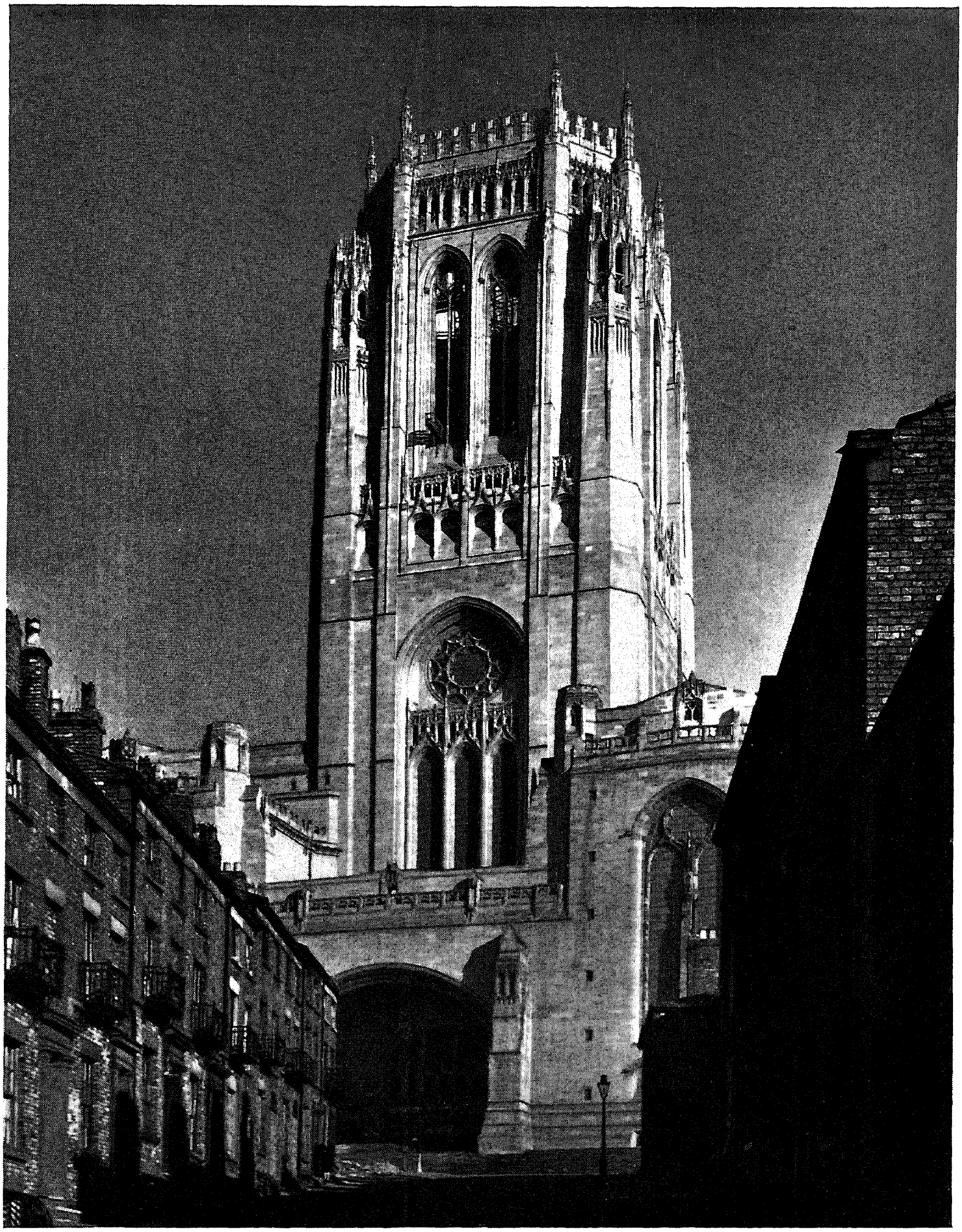
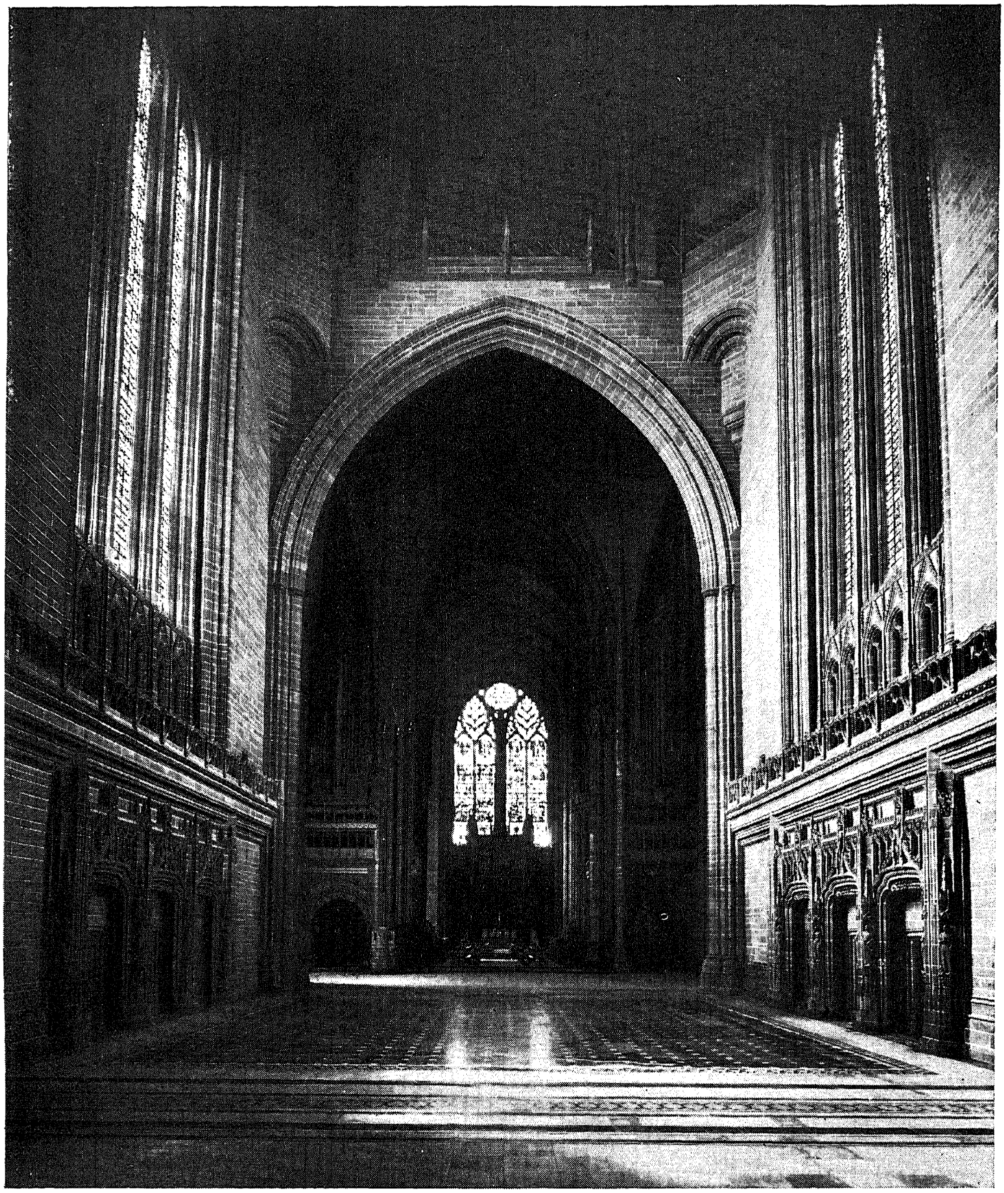
[1] W. R. Lethaby, *Philip Webb and his Work* (London, 1926), p. 128.

[2] In addition to the monumental buildings in the Greek style for which Schinkel is mainly known, he designed a villa like a medieval castle for Prince Wilhelm at Potsdam and made several other projects of a like nature.



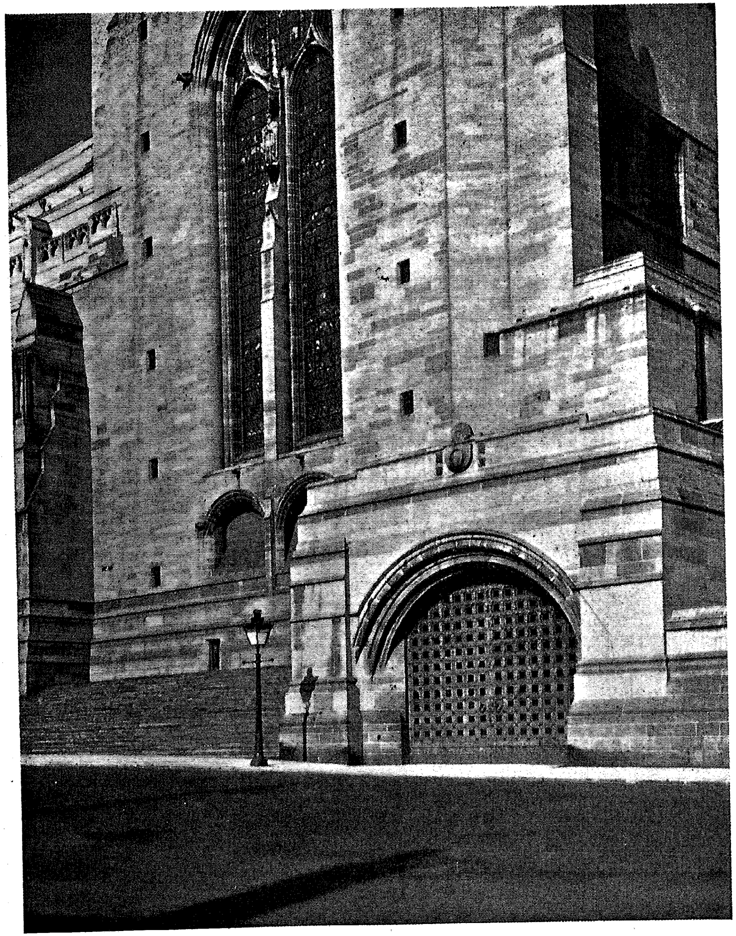
LIVERPOOL CATHEDRAL (BEGUN 1903). VIEW OF THE TOWER
Architect: SIR GILES GILBERT SCOTT

PLATE V

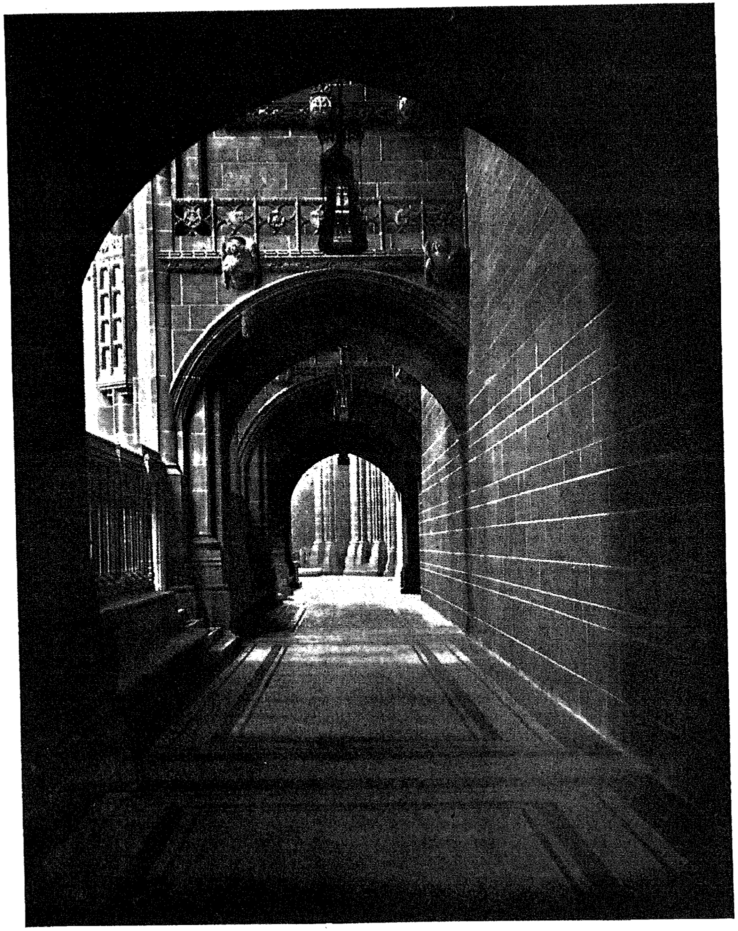


LIVERPOOL CATHEDRAL (BEGUN 1903). VIEW LOOKING EAST
Architect: SIR GILES GILBERT SCOTT

PLATE VI



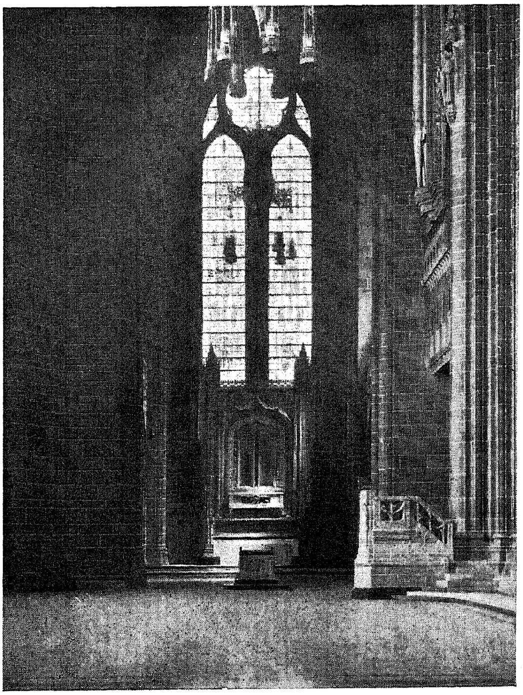
A CORNER OF THE EAST TRANSEPT



THE NORTH CHOIR AISLE, LOOKING WEST

LIVERPOOL CATHEDRAL (BEGUN 1903). *Architect*: SIR GILES GILBERT SCOTT

PLATE VII



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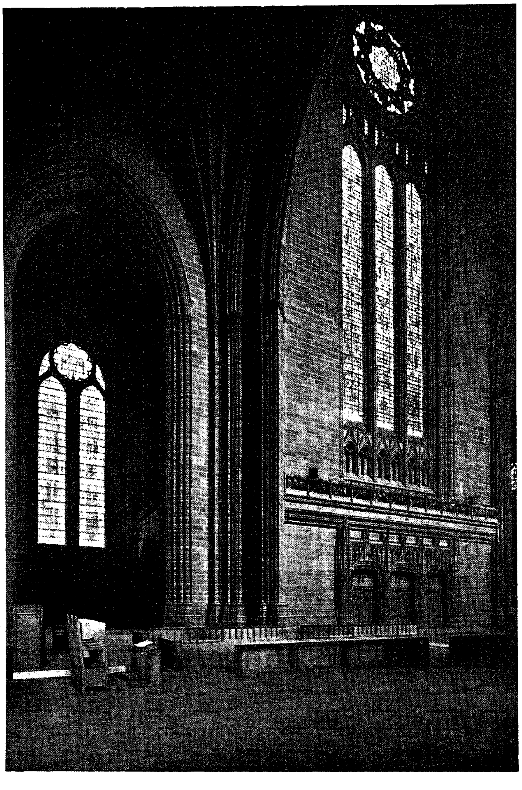

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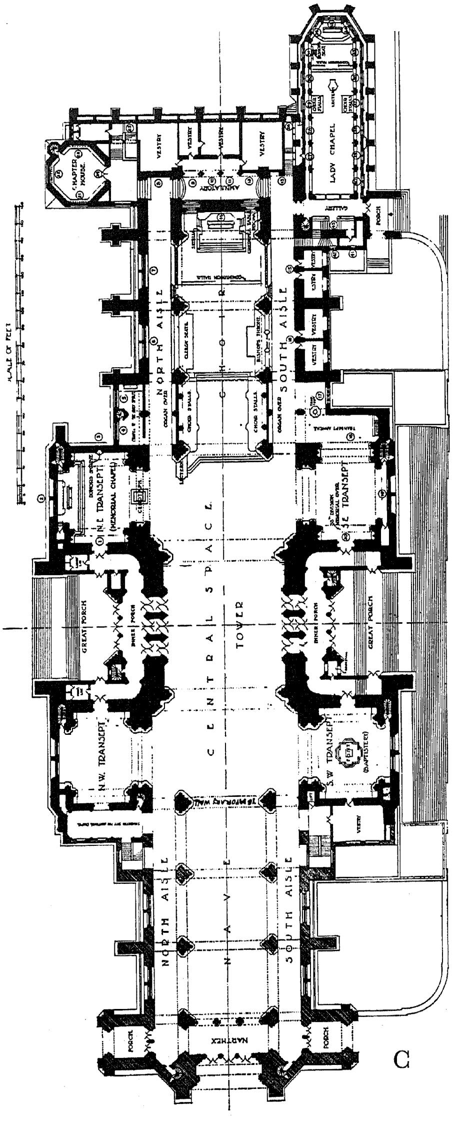

C

LIVERPOOL CATHEDRAL

Architect: SIR GILES GILBERT SCOTT

A. VIEW OF WAR MEMORIAL TRANSEPT

B. VIEW OF CENTRAL SPACE UNDER TOWER AND NORTH-WEST TRANSEPT

C. PLAN, THE PORTION HATCHED, NAMELY THE NAVE, INDICATES THAT THIS HAS YET TO BE COMPLETED

PLATE VIII

garden city, and of the domestic architecture of Voysey and Frank Lloyd Wright. His houses are still stylistic in appearance, being designed mainly in the Romanesque style, but he rendered the great service of freeing the plan from classical symmetry and formality. He had some following after his death in 1845, and was regarded as the founder of the Romantic school of architecture known as *Landschafts-Architektur.*[1] The school did not develop very extensively.

The romantic manifestation in England of Pre-Raphaelitism was associated with the domestic architecture in which design, more in accordance with purpose, and building with a greater sense of the fitness of materials, first arose. William Morris and his friend Burne-Jones had a deep and romantic love for the art and life of the Middle Ages, and they really attempted the hopeless task of reviving the conditions of work that they felt had made medieval craftsmen happy. The creed of the principal Pre-Raphaelites, Rossetti, Millais, and Holman Hunt, arose from a dissatisfaction with so much of the melodramatic, theatrical, commercial, and insincere painting since the Renaissance, and they desired to paint more in the sincere spirit of earlier painters, with their faithful and minute renderings of natural forms. It was a romantic yearning for the remote.

Though Ruskin, Morris, and Burne-Jones were stimulated in their thought by this romanticism of the Pre-Raphaelites, and of earlier poets like Scott, Wordsworth, Coleridge, Shelley, and Keats, their romantic impulses were more consciously intensified by the detestation of the sordid industrial life growing in mid-nineteenth-century England, involving long hours of monotonous machine work in factories for people who lived in foul and sordid conditions. Machinery was also responsible for the ugliness of things of everyday use, such as were exhibited at the Great Exhibition of 1851. The machine, but more particularly its improper use, was blamed for this ugliness, unhappiness, and squalor. And thus there is that yearning for the partial revival of that happier medieval world. 'The social life of the Middle Ages allowed the workman freedom of individual expression, which on the other hand our social life forbids him', says Morris.[2] By this passionate romantic social feeling he was led to the pronouncement that 'Art is Man's Expression of His Joy in Labour'[3] which will not, of course, survive a moment's examination. Mere utilitarianism, however good the work, if it

[1] Some reference is made to Persius' work in Walter Curt Behrendt's *Modern Building*, pp. 43, 47.

[2] 'The Revival of Architecture', *Fortnightly Review*, 1888.

[3] 'Art Under Plutocracy.' Lecture at Oxford, 14 Nov. 1883.

was the product of machinery, he condemned. The life of the Middle Ages 'did not put into the hands of the workmen', he writes,[1] 'any object which was merely utilitarian, still less vulgar; whereas the life of modern times forces on him the production of many things which can be nothing but utilitarian, as, for instance, a steam engine'. Architects later were to see much beauty in the steam engine and other such machinery, a beauty perhaps equal to the best of William Morris's own productions, and to those of medieval craftsmanship which he loved so much. William Morris and his associates were too intent on looking romantically backward into the golden age of the medieval world to think seriously of the aesthetic possibilities of machine production. If it had any possibilities for them they were merely social.

Yet looking romantically backward as they did, it was William Morris and his architect, Philip Webb, who, more than Schinkel, more than Persius, more than Labrouste, took the most decided step forward towards an architecture expressive of purpose and of contemporary life, a step which is important more for its influence than for the actual work that was produced.

After William Morris married he wanted a house and he and his architect, Philip Webb, built one at Bexley Heath, now famous throughout the world as the Red House. In looking for furnishings he found none sufficiently good available among contemporary productions, so low was the state of applied art; so with his associates he formed a firm under the name of Morris, Marshall, Faulkner & Co. to produce the furnishings for the house. This firm continued afterwards, but initially in a somewhat unbusiness-like manner, until it was better organized on business lines by Warington Taylor. It has continued ever since. But furniture and interior decoration, which was the product mainly of good designers and hand craftsmanship, could only be purchased by the well-to-do, a circumstance rather bitterly resented by Morris, when he remarked that he spent his life 'ministering to the swinish luxury of the rich'.[2] The poor, presumably, were to have machine-made articles or go without.

The Red House was the first of many houses by Philip Webb—and they represent the eve of the great achievements of English domestic architecture from about 1860 to the outbreak of the First World War (Webb died in 1915). They were designed as the result of logical thought about the purpose they were to serve. The Red House (1860), the house at Palace Green,

[1] 'The Revival of Architecture', op. cit.

[2] *Philip Webb and his Work*, by W. R. Lethaby (London, 1935), p. 94.

Kensington (1868), Joldwynds, Surrey (1873), Clouds, East Knoyle, Wiltshire (1881), Coneyhurst, Ewhurst (1886), Standen, East Grinstead (1892), Exning, Newmarket (1896), are some of the best-known examples of his houses, and if the plans of these are studied, it will be noted that they are all designed primarily with a view to the convenient relationship of parts, while some are orientated so as to get a fair degree of sunlight for the principal rooms. It must be admitted, however, that the Red House is unsatisfactory in this last respect as the principal rooms face north. The L shape was adopted in the Red House and many of his later houses. The advantage of such a shape is that it allows for rooms to be arranged in a sequence which is generally convenient as, for example, the sequence of scullery, kitchen, pantry, dining-room, drawing-room; and at the same time allow for maximum window space. The advantages over the symmetrical block plan where rooms are arranged somewhat on the chess-board pattern is obvious. Webb did not avoid symmetry because it was a characteristic of the imported Renaissance architecture he disliked. If by symmetrical planning the purpose of the house could be equally well achieved he employed it, as in houses like Clouds and Smeton Manor,[1] in the valley of the Swale. Clouds shows the influence of symmetrical designing more than most of his houses. Lethaby points out with reference to it, 'symmetry is a guide up to a point but nothing of importance is sacrificed to it'.[2] Webb never planned symmetrically for the sake of symmetry, as did Renaissance architects, even if he were requested to do so by a client. If the client was insistent Webb's reply was that the client should get another architect. Webb always made it clear to his client that the house was to be built as he (Webb) thought it should be built. It would be a good thing for architecture if all architects could show this independence. Too often their attitude is that of Basset, one of Webb's assistants, who remarked that 'Webb will worry himself to fiddlestrings if he argues so much with his clients; I would put the drains on the top of the house if they wanted it'.[3] Another valuable contribution that Webb made to modern architecture was his expressive and appropriate use of materials. He always studied local materials and buildings so that his house should belong to its surroundings. Thus, if the traditional building material of a district is limestone, or sandstone, or brick, this determined the selection of his building material. Thus Arisaig, near Fort William, on the west coast of Scotland, is built of the hard local stone, Clouds, in Wiltshire, is built of local sandstone, while Red House and other houses in the south-east are of brick. His London houses, like that at Palace Gardens, are generally built of brick with stone dressings. He studied all materials used in building and tried to use them well. As Lethaby remarks, 'he was deeply interested in limes and mortars, the proper ways of laying roofs, tiles and forming chimneys, of finishing plaster ceilings and mixing whitewash.'[1]

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[1] This house is described by W. R. Lethaby in his book on *Philip Webb and his Work* (London, 1935), p. 95.

[2] Ibid., p. 101.

[3] Ibid., p. 117.

Although Philip Webb was influenced by Gothic architecture, and this influence is apparent in his work, his houses are in no sense stylistic. He aimed at carrying on the medieval tradition of good, honest, and efficient building, from the point where it had been interrupted by the importation of Renaissance architecture. 'Architecture to Webb', says Lethaby,[2] 'was first of all a common tradition of honest building. The great architectures of the past had been noble customary ways of building, naturally developed by the craftsmen engaged in the actual works.'

It is probable that Webb's work had some influence on the early domestic architecture of Richard Norman Shaw. The extent of that influence is deduced from Shaw's work, as he never acknowledged it. Of the same age (born in 1831), Shaw succeeded Webb as Street's chief draughtsman, and afterwards was Nesfield's partner until 1868. Shaw designed a very large number of houses from 1868 to about 1900, but very few are as good as Webb's. Unlike Webb, Shaw was not content with simple direct building, but introduced 'period' ornamental features, the principal early essays of which were in the Tudor style with half-timbered effects, which he employed as early as 1868 in the house at Leys Wood, Sussex, and which he used in numerous subsequent houses. Though many of his early plans are determined mainly by convenience, he rarely seems to be free of the influence of traditional symmetrical planning, and later makes it a definite aim. His best houses are those in London, where the Tudor influence is succeeded by that of the brick architecture, high chimneys, and gables of the Dutch-begotten Queen Anne style. What makes them good buildings has nothing to do with stylistic reminiscences, they are good because they have a simple and dignified appearance, and because they are planned with purpose rather than with symmetry as the guide. Some of the best examples are in Queen's Gate. The best, I think, are numbers 180 and 185, built in 1885 and 1890, where simplicity, dignity, and planning for purpose are most apparent. The larger house at 170 is designed symmetrically and is less

[1] *Philip Webb and his Work* (London, 1935), p. 122.

[2] Ibid., p. 119.

interesting. One of Shaw's best plans was that for the house he built for Edwin Long, at 42 Netherhall Gardens, and which was destroyed about 1937. Probably one of the reasons it was so good a plan is that Long's requirements were rather exacting. On the ground floor the rooms are arranged in convenient sequence, from scullery, kitchen, servants' sitting-room, pantry, servery, and dining-room, with a long corridor with porch at the side at one end and stairs at the other end. On the upper floor is a large studio and drawing-room placed conveniently in relation to each other. There are numerous details in the plan which testify how well thought out it is. As Sir Reginald Blomfield says, 'the plan was an admirable example of skilful planning to meet special requirements. In its way it was one of the best pieces of domestic architecture that Shaw ever did, and illustrates his originality in planning. Instead of following accepted conventional models, Shaw faced each problem on its merits, with full and very alert consciousness of the possibilities of effect latent in his plans when translated into terms of building.'[1] The curious thing is that Shaw later restricted his freedom to 'face each problem on its merits' by returning to the symmetrical convention, and Blomfield approves this change.

The work of C. F. A. Voysey (born 1857) is the product of the same spirit and belongs to the same movement as that of Webb and the best work of Shaw. His best work is at least equal to the best work of Webb, and some critics would regard it as representing the finest achievement in domestic architecture in Europe for the period, from about 1888 to about 1908. Like the work of Webb, Voysey's houses were not designed to follow any particular style, but were the product of simple, direct, and honest building. Voysey used materials well, his houses have simple exteriors, with a generous and effective use of plain surfaces; none of Shaw's sham half-timber work. He had a liking for stuccoed or whitewashed treatments. He planned his houses strictly according to the purpose they had to serve, and the majority have the convenient chain of rooms, formed as an L or E, and orientated with thought of the sun. Also he wedded his houses satisfactorily to the garden setting, and his planning generally continued with the garden; thus he is a link, unconsciously perhaps, between Ludwig Persius and Frank Lloyd Wright. A particularly good example of his work is The Homestead, Frinton-on-Sea (Plate XI). It is planned as an L, the parlour and dining-room being along one arm, running north and south, with the kitchen and scullery in the other arm, running east–west, with the garden designed as part of the plan. Other good examples are Perrycroft, Colwall (1893),

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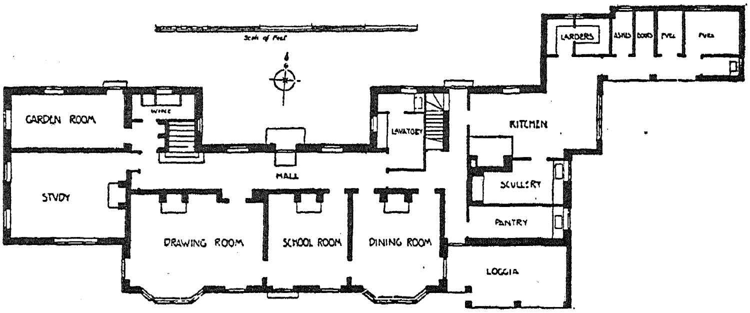
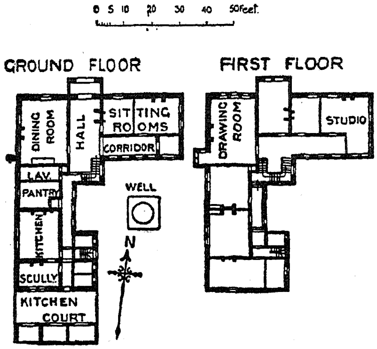
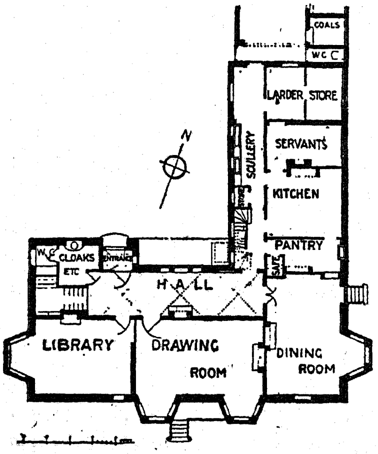
[1] *Richard Norman Shaw*, by Sir Reginald Blomfield (London, 1940), p. 44.



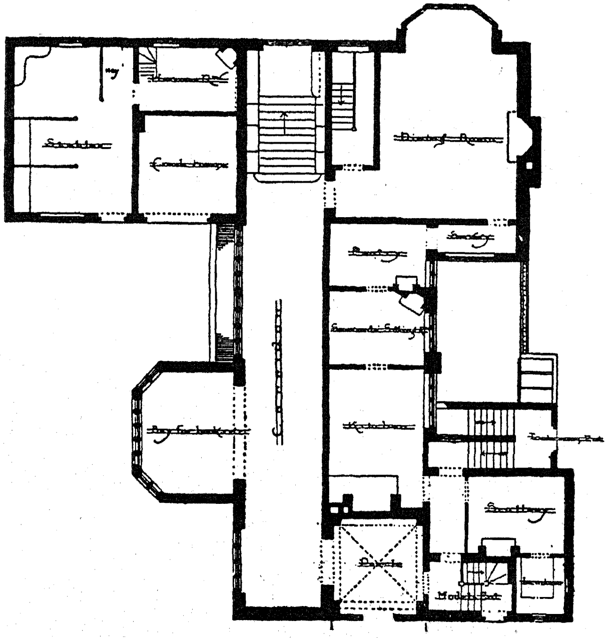
MOUNT BLOW, GREAT SHELFORD (*c.* 1900)
Architect: SIR EDWIN LUTYENS, O.M., P.R.A.



THE RED HOUSE, BEXLEY HEATH
(1859)
Architect: PHILIP WEBB



HURST, FOUR OAKS (*c.* 1900)
Architect: W. R. LETHABY



42, NETHERHALL GARDENS, HAMPSTEAD (1888)
Architect: NORMAN SHAW

PLATE IX

a house at Sackleford, in Surrey (1897), The Pastures, North Suffenham, Rutlandshire (1901), and his own home, The Orchard, at Chorley Wood (1899). It will be noted in Voysey's houses that the elevations are generally less symmetrical than either Webb's or Shaw's. They are dictated very largely by the plans, and are an expression of the natural arrangement of each house. More than with any houses of their time it is possible to tell internal arrangement by the appearance of the exterior.

Webb, Shaw, and Voysey were the three chief architects of domestic buildings in Europe from about 1860 to 1905. No other European architects built houses in that period at all comparable with theirs. Their influence in Europe has been wide and profound. In England they were followed by a very large number of architects, who, though producing many good works up to 1919, added nothing to their achievements, but merely produced variations on their themes. Among their most successful followers in the field of domestic architecture in England were Baillie Scott, C. R. Ashbee, W. R. Lethaby, P. Morley Horder, Arnold Mitchell, A. N. Prentice, Sir Edwin L. Lutyens, and Ernest Newton. The influence is seen in smaller houses designed for repetition in numbers, which I will consider later. Rarely does the work of these architects reach the standard of Webb, Shaw, and Voysey, but being mainly actuated by the same principles of functional design, and simple, direct, and efficient use of materials, it is generally good work. With Baillie Scott's houses there is a somewhat conscious looking back to the small medieval country house, repeating many of its features without sufficient reference to modern purposes. There is a tendency in his houses to revive the hall as the central feature with smaller rooms grouped round. In the plan of a house that he published in *The Studio* of 1900 the hall is the large central room with other rooms grouped round, and the rooms are significantly called refectory, bower, den, instead of dining-room, drawing-room, and study. One is almost prompted to ask why he did not put a dais in the hall.

Some architects, like Sir Edwin Lutyens and Ernest Newton, seem to find it difficult to resist the impulse to make symmetrical plans and elevations. In the case of Ernest Newton, though many of the plans are good, they are restricted in freedom by this symmetry, and with Sir Edwin Lutyens's houses, although many of the plans are designed according to the greatest convenience of arrangement, the elevations are symmetrical, which often means a contradiction between the two. An example is an early work: Mount Blow, Great Shelford, where the symmetrical fenestration does not correspond with the more irregular arrangement of the rooms. This passion for symmetrical elevations means that he sometimes puts odd little windows into rooms, which are not explained from the interior, the reason for their insertion only becoming apparent when the exterior symmetrical elevation is seen.

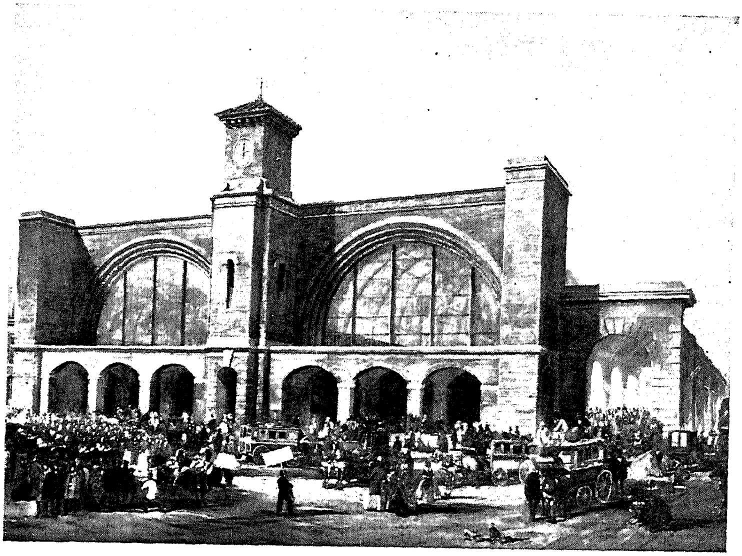
As before indicated, the English domestic architecture from 1860 to 1905 had a profound influence on many continental architects, especially in Germany, Austria, France, Holland, and Belgium. Hermann Muthesius, the German architect, had spent some time in England from about 1898 to 1903, and he was full of enthusiasm for English domestic architecture—an enthusiasm he imparted to his fellow German architects in several books. *Die englische Baukunst der Gegenwart* was published in Leipzig in 1900, *Das englische Haus* in Berlin in 1904, and *Kunstgewerbe und Architektur*, in which there is a chapter on *Das englische Haus*, in Jena in 1907.

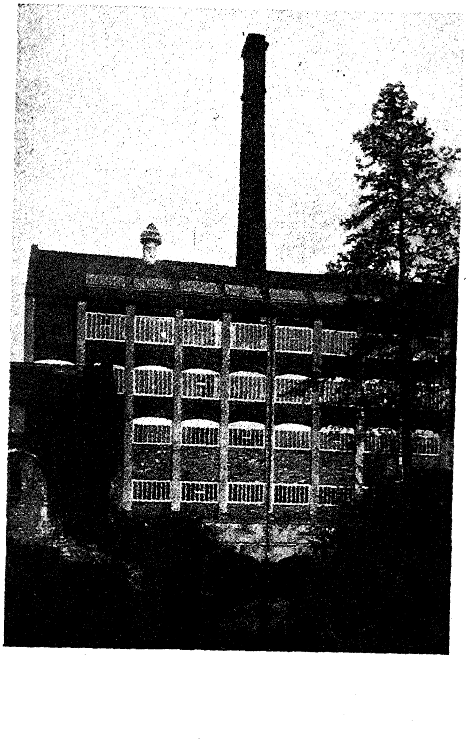
The influence of English domestic architecture on the Continent before Muthesius wrote his books is not easy to assess, but many houses in Germany, Austria, France, and Belgium appear to show its influence. Belgium offers an interesting parallel to the building of the Red House in Henry Van de Velde's house in the Avenue van der Raye, at Uccle, a suburb of Brussels. When Van de Velde married, he built himself a house between 1893 and 1895, thus about thirty-five years after the Red House, and finding, like Morris, contemporary interior decoration and furnishing of a very low quality in design, he designed everything for his house. It would appear that building and furnishing his own house, because nothing in contemporary art was of an artistic standard that he required, was the result of Morris's example. This is doubtful and cannot be proved either way. Siegfried Giedion does not think that Van de Velde followed Morris's example, but attributes the parallel to the fact that 'identical conditions led to identical reactions'.[1] Van de Velde must have known about the Red House and its furnishing, and it is not improbable that it provided a background which prompted similar action. The conditions in Belgium were not dissimilar from those in England thirty years earlier, for Belgium was one of the earliest of continental countries to become industrialized.

One of the most noteworthy of German architects, whose domestic work appears to show English influence, is Peter Behrens. Like Van de Velde and many other famous architects he began as a painter, and later turned to designing objects of use of all kinds from buildings to tea-cups. In 1901 Behrens built himself a house at Darmstadt, and this represents his first

[1] Siegfried Giedion in his book *Space, Time and Architecture* (Cambridge, U.S.A., 1940), p. 217.

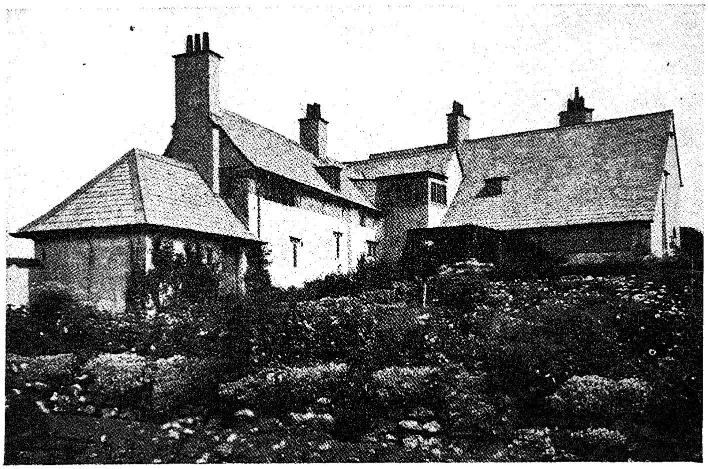
THE EXTERIOR OF KING'S CROSS STATION AS IT WAS ORIGINALLY IN 1852
Architect: LEWIS CUBBITT





STANLEY MILL, STROUD, GLOUCESTERSHIRE, BUILT 1813

(*Reproduced by courtesy of the Owner, Mr. H. Winterbotham and* The Architectural Review—*see 'Stroud Valley Doric', pages* 53–5, *February*, 1943)



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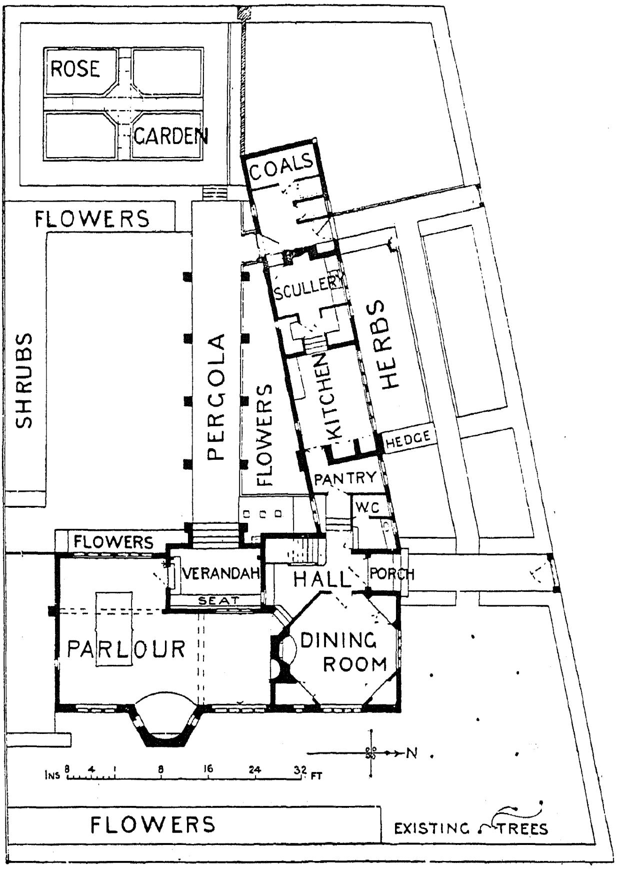
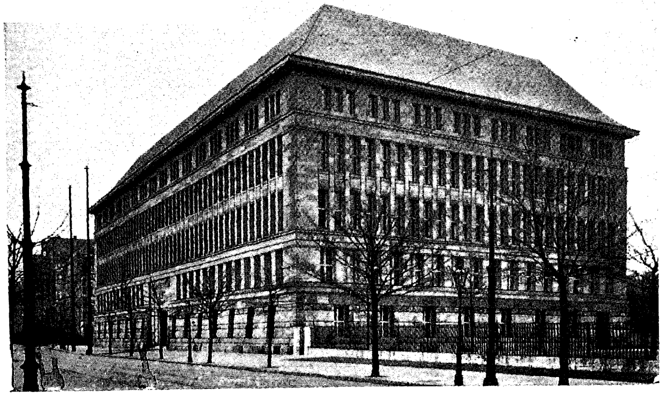


B

THE HOMESTEAD, FRINTON-ON-SEA
(1899)
Architect: C. F. A. VOYSEY
A. A VIEW FROM THE GARDEN
B. PLAN

PLATE XI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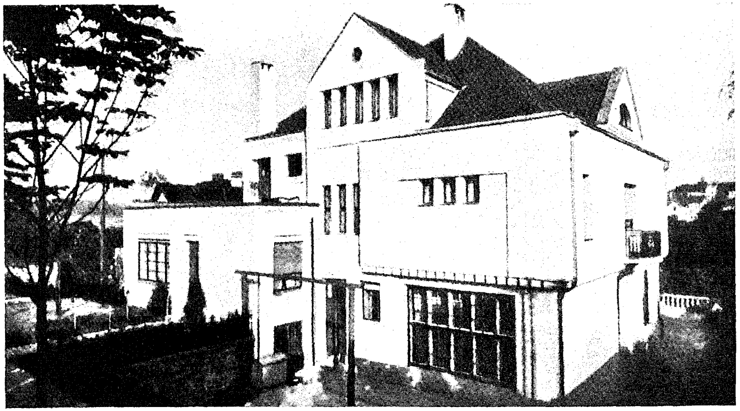
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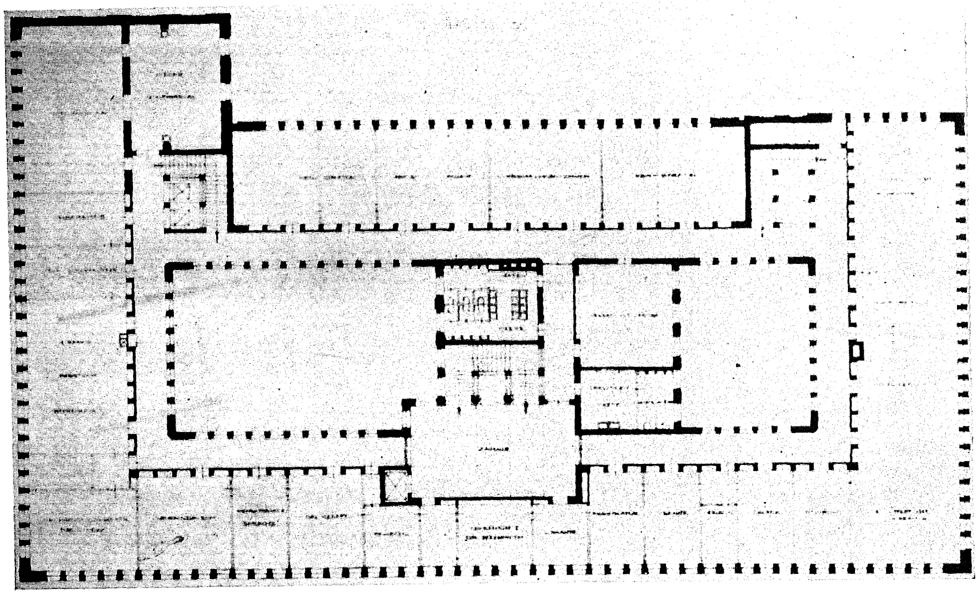
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A. ADMINISTRATIVE HEADQUARTERS, THE MANNESMANN TUBE COMPANY, DÜSSELDORF (1911)

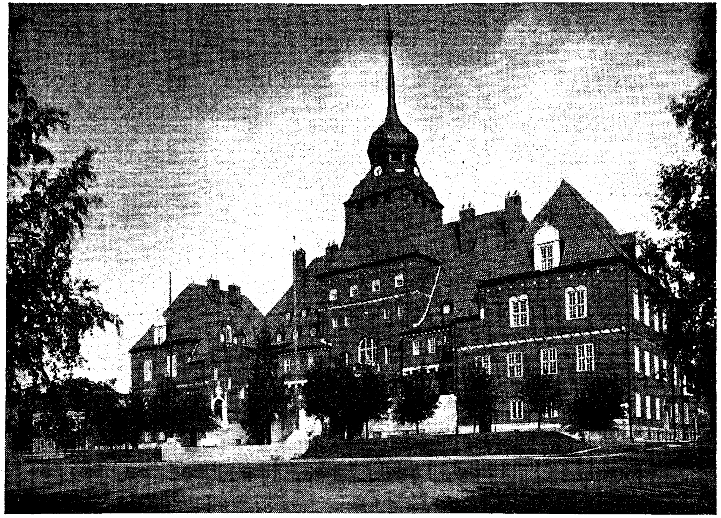
B. PLAN

Architect: PETER BEHRENS

C. HAUS OBENAUER, SAARBRÜCKEN (1905)

Architect: PETER BEHRENS

PLATE XII



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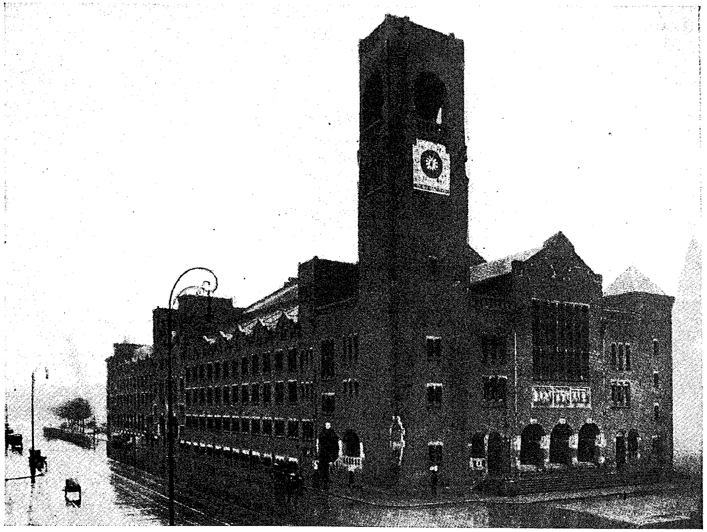

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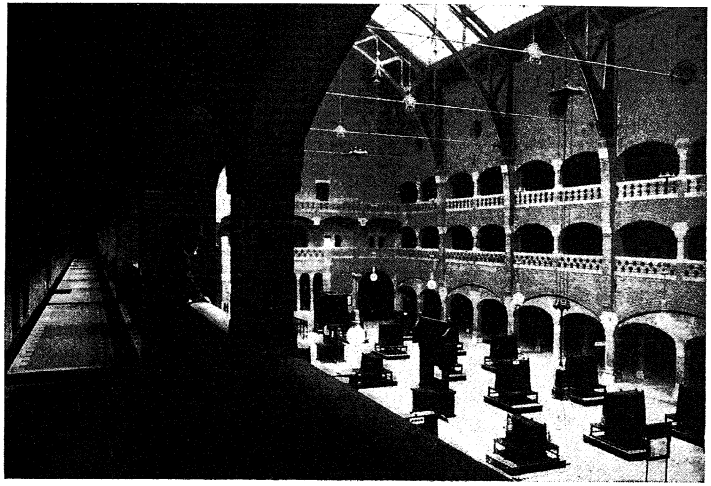


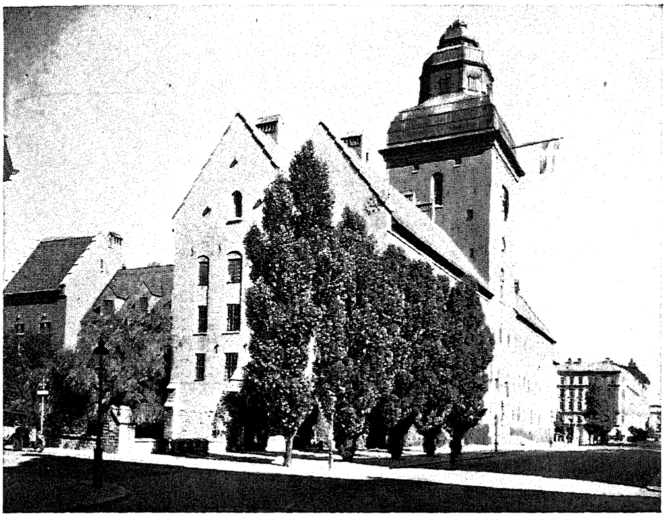
C

A. THE TOWN HALL, OSTERSUND—AN EXAMPLE OF THE TENDENCY TOWARDS SIMPLICITY AND THE USE OF LARGE EXPANSES OF PLAIN BRICK WALL (COMPLETED 1912)
Architect: I. WALLBERG

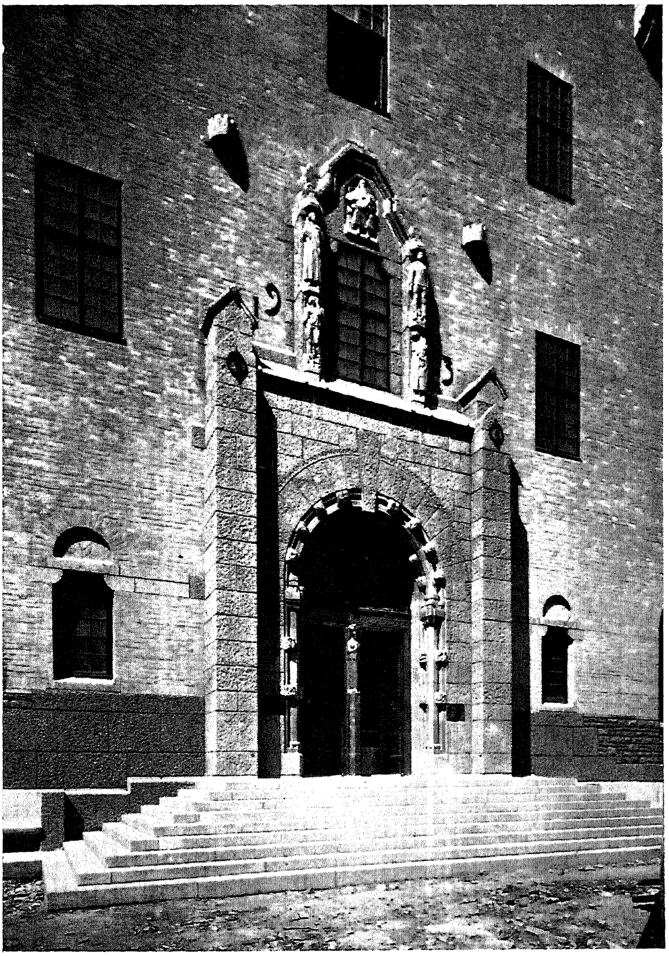
B. THE EXTERIOR OF THE AMSTERDAM STOCK EXCHANGE (1898–1903)
Architect: H. P. BERLAGE

C. THE INTERIOR OF THE AMSTERDAM STOCK EXCHANGE

PLATE XIII

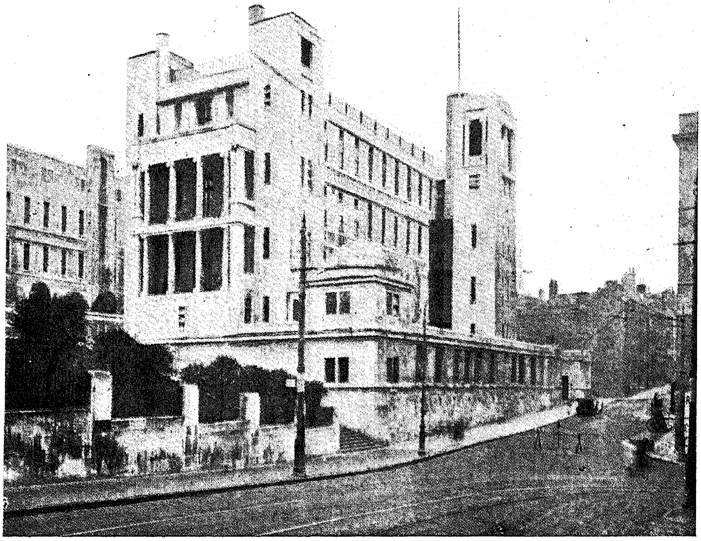


THE CITY LAW COURTS AT STOCKHOLM (COMPLETED 1913)
Architect: CARL WESTMAN

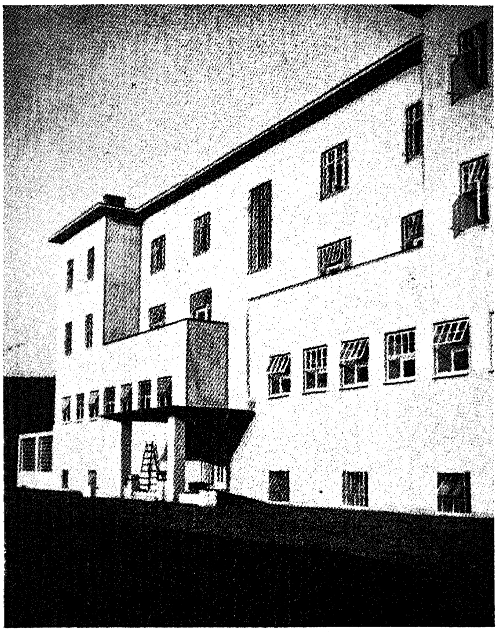


THE ENTRANCE TO THE SAME BUILDING

PLATE XIV

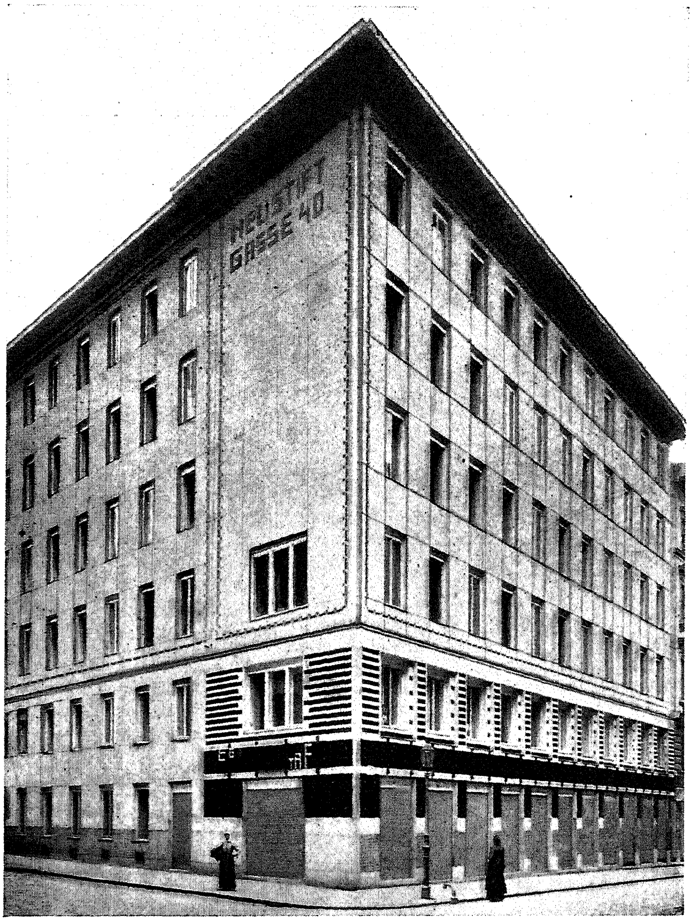


THE ROYAL INFIRMARY, BRISTOL (1906)
Architects: ADAMS, HOLDEN, AND PEARSON

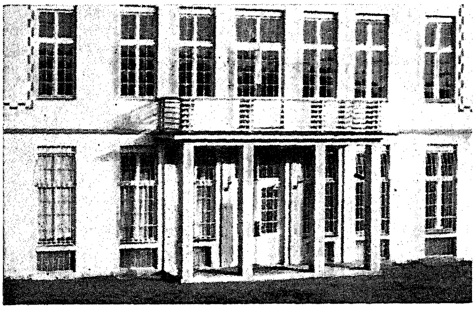


THE PURKERSDORF SANATORIUM (1903)
Architect: JOSEPH HOFFMAN

PLATE XV

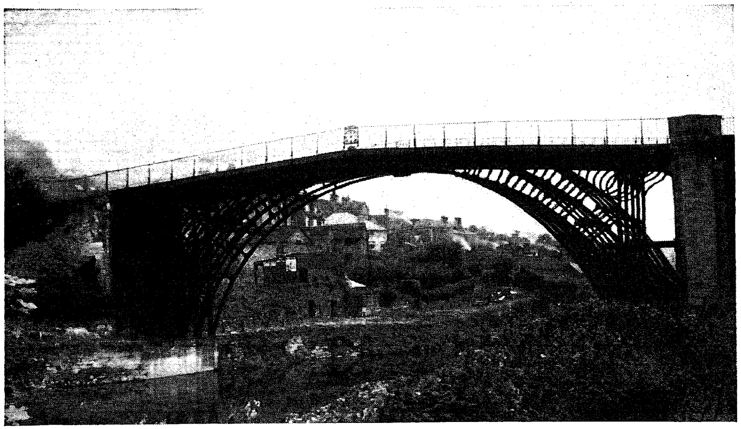


FLATS IN THE NEUSTIFTGASSE,
VIENNA (*c.* 1900)
Architect: OTTO WAGNER

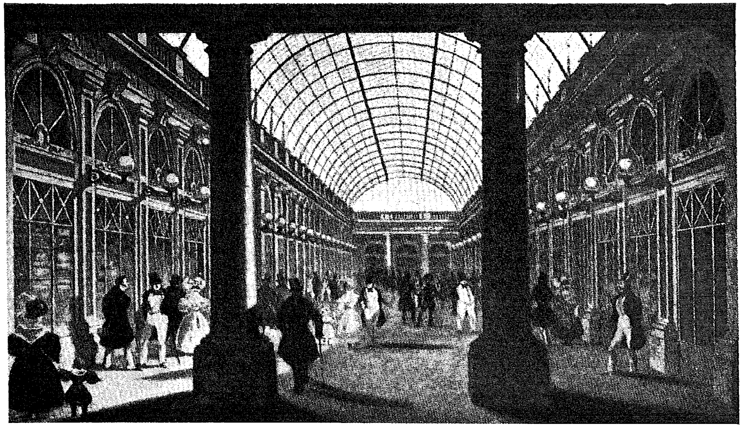


ENTRANCE TO CLINIC AT MITTELBAU
Architect: OTTO WAGNER

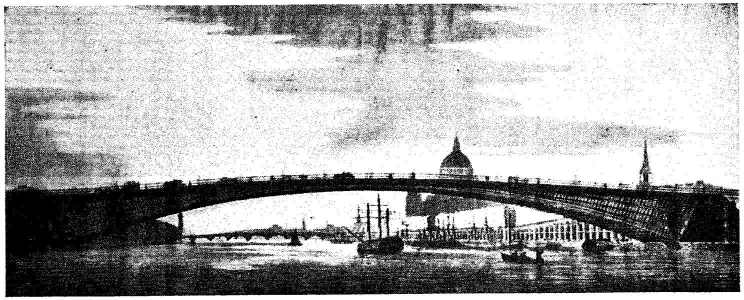
PLATE XVI



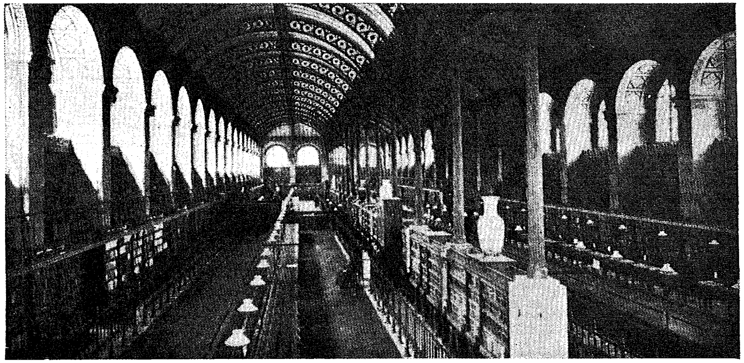
THE COALBROOKDALE BRIDGE, BUILT IN 1779 TO THE DESIGNS OF THOMAS FARNOLLS PRITCHARD AND CARRIED OUT BY JOHN WILKINSON



AN EARLY EXAMPLE OF THE IRON AND GLASS ROOF—THE GALERIE D'ORLEANS, BUILT 1831, DESTROYED 1935
Architect: FONTAINE



THE DESIGN FOR A SINGLE-SPAN LONDON BRIDGE, MADE IN 1801 BY TELFORD AND DOUGLAS, BUT NEVER EXECUTED



THE BIBLIOTHÈQUE SAINTE-GÉNEVIÈVE, PARIS (1843). AN IRON CONSTRUCTION WITHIN STONE WALLS
Architect: HENRI LABROUSTE

PLATE XVII

building. It is not improbable that the design of this house, with its emphasis on verticals and its curved gables, was influenced by C. R. Mackintosh. Behrens followed this with several houses, all somewhat in the English style, up to about 1910; among them may be mentioned a house at Wetter in the Ruhr (1904), the Haus Obenauer at Saarbrücken (1905), and two houses in the Eppenhaus Garden Suburb at Hagen (1908 and 1910).[1] The last two are conceived on formal and symmetrical principles, but the others, like the best English houses, are determined by convenience and have irregular plans and groupings of the various parts. One of the best is the Haus Obenauer, which clearly shows Voysey's influence, and like Voysey's houses it has large, plain, white walls. There is one feature in these houses which represents a slightly more adventurous treatment than is found in contemporary English work, and that is the very large windows employed for the principal living-rooms, in some cases, as in the house at Wetter, almost a glass wall, thus bringing light and air into the room to a greater degree than before. This is a significant advance (see Plate XII c).

We must leave houses and turn to other buildings, where the development towards a living, expressive, and functional architecture was later in starting. It was probably as the result of the example of domestic architecture that freer planning for public and commercial buildings began; but also, I think, because the crowding of buildings in London and other big cities presented awkward sites for new buildings, and symmetrical plans were often impossible, while the sites were sometimes so awkward that the problem of fitting the parts into a desirable sequence made the employment of classical formalism very difficult. It is interesting to note that some of the best plans from about 1885 to 1914 were evolved in this way. As is so often the case in art, it would seem that the severer the restrictions the more ingenious the design. (It will be remembered that one of Norman Shaw's best plans was the outcome of exacting demands.) The Bishopsgate Institute, built by C. H. Townsend in 1892–4, is an example. The site is long and awkward with a small frontage to Bishopsgate between other buildings, and in this area it was necessary to get a fairly large hall, a small hall, lending and reference libraries, and newspaper room. On the ground floor three principal rooms; the large hall and the lending and reference libraries are arranged in succession with a corridor running at one side. The difficulties of the site have been well overcome, and it is not easy to see how a symmetrical plan could have been adopted, or how, given more space, a symmetrical plan would have served the purpose better. In his Whitechapel Art Gallery (1897–9) C. H. Townsend had more freedom, but he has employed symmetry here only where it suits purpose as well as a less formal arrangement. In the elevation, for example, the upper part is symmetrical, but he places the entrance to one side, to allow for an exit to the right. To have had the entrance in the centre would have meant, to the architect, some sacrifice of the efficient fulfilment of purpose.

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[1] These houses are illustrated in the *Architectural Review*, vol. lxxvi, Aug. 1934, pp. 40 and 42, and for Sept. 1934, p. 84.

The Glasgow School of Art, by C. R. Mackintosh, is often claimed as one of the pioneer works of a living, modern architecture, and there is justice in the claim; but to say that it is the first building of the new architecture or the first modern building is an extravagant assertion. It is one of many pioneer works produced between 1890 and 1914 which laid the foundations of the new architecture.[1] In the earlier part, built in 1898–9, there is, as in Townsend's work, a combination of the symmetrical and asymmetrical, and the building is designed excellently for the purpose it is to serve, with very large windows, as is required by an art school. There is an economy of ornament, and the structure is not concealed but is rather made the most of and taken as a decorative motif as in the gallery supports of the library. Its value is that, like Webb's houses, it is direct, honest building where purpose guides its design and where structure and materials are frankly revealed and themselves supply the decorative motifs.

The departure from the formal symmetrical plan we have noted in Labrouste's Bibliothèque Nationale, built between 1858 and 1868. Such departures on the Continent up to the last decade of the nineteenth century were rare exceptions to the general rule. When they did occur it was generally in smaller buildings which had to fit awkward sites in congested areas of cities, and the virtue of the irregular plan arose out of necessity as in the case of the Bishopsgate Institute. But during the nineties, and more in the early twentieth century, partially as a result of the example of the English house and of a weakening of the classical tradition of symmetry, the plan dictated more exclusively by convenience was gradually becoming a more conscious aim. The house at 12 Rue de Turin, in Brussels, built by Victor Horta in 1893, famous for its *L'Art Nouveau* decorations, shows a remarkable organization of interior space. It is a long, narrow site between other houses, and although the front part of the ground floor is symmetrical, in the remainder this symmetry is abandoned for more convenient planning, while rooms are related at half-story levels so as to get the maximum accommodation in so limited a space. In his House of the People, at Brussels, built in 1897, Horta has evolved even more flexible planning for an awkward but much more spacious site. This building is also valuable as a pioneer work in iron and glass construction and I will refer to it again in this connexion. The Amsterdam Stock Exchange building erected from 1898 to 1903, by H. P. Berlage, is another building which shows this growing freedom in planning, and examples become commoner every year. A building like the administrative headquarters of the Mannesmann Tube Company, Düsseldorf (1911), by Peter Behrens, represents an interesting advance in functional planning because the size of the rooms is determined by space required for the free and efficient movement of a team of clerks, and this office unit is repeated, and determines the use and size of standardized steel stanchions. The plan results largely from considerations like this. The growing freedom of interior space designing was to be greatly assisted by the increasing use of steel, concrete, and glass (see Plate XII A and B). The developments in the use of these materials will be traced in a subsequent chapter.

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[1] I use this term in the sense that it is used by Walter Gropius, Eric Mendelsohn, and others of its exponents. It is not an ideal term, but it is a concise designation of what is regarded as a living architecture expressive of man's social, scientific, and industrial progress.

The influence of Otto Wagner is important in the movement towards a living architecture, especially in his teaching. In 1894, when 53 years of age, he became professor of architecture at a Vienna Academy. So far he had produced buildings in the Renaissance tradition generally with a tendency towards more and more simplification. But his teaching at the Academy, the essence of which is contained in a book entitled *Moderne Architektur*, published in Vienna in 1895, is not based on his earlier practice. He, like Schinkel and Labrouste many years before, felt the need for an architecture that emerged from and expressed contemporary life. He believed in the use of materials that modern industry could provide, and in an honest expression of these materials. He also believed that objects could not be beautiful unless they were well fitted for their purpose. Amongst his later works there is some exemplification of his principles, the block of flats in the Neustiftgasse, Vienna (1902), and the Post Office Savings Bank in Vienna (1904–6) being among the best examples. He rarely departs, however, from classical symmetry in his planning. His teaching raised considerable opposition amongst conservative and academic thought, yet many of his pupils later became important figures, and his teaching contributed to laying the foundation of a great school of modern architecture.

CHAPTER V

The Search for a Style—L'Art Nouveau

FOR the last twenty years of the nineteenth century Brussels was one of the chief centres of European art, and was more liberal in its attitude to new movements and young artists than any other European capital. It welcomed Cézanne, Van Gogh, Seurat, Rodin, and others, and was a centre for the development of ideas and movements. It was here that *L'Art Nouveau*[1] was born and Van de Velde and Victor Horta are usually regarded as its authors.[2] It was part of the general effort to originate an art which was not dependent on historical styles, and it manifests as an art of rhythmical lines and appears in many forms of plastic and pictorial art from book illustration to architecture. Its first conspicuous manifestation in architecture was in the decorations of the house in the Rue de Turin, Brussels, designed by Victor Horta, mentioned in the last chapter. Here the iron columns and balustrade and the wall decorations consist of flowing rhythmical lines. In Horta's later work, the House of the People in Brussels, also mentioned in the last chapter, the decoration is still of a similar character, especially in the balcony railings of the hall, but it is much more restrained. *L'Art Nouveau* was concerned with decoration, and it had little influence on architectural design and construction.

There are many speculations as to the origin of the style, for no style can come into being without some parentage. The decorations of Horta's House bear closest resemblance to the tendrils of plants, and these might have provided suggestions, but they do not explain why such decoration is employed. Giedion[3] thinks it is the linear decoration of iron constructions: 'the unrolled curls and rosettes that are to be found under the eaves of so many Belgian railway stations.' But these are of a much more confined, conventional, and static character, and could hardly prompt the free linear rhythms of *L'Art Nouveau*. I am inclined to think it is another legacy of medieval and early

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[1] The movement was known as *L'Art Nouveau* in France, Belgium, and Britain, as *Jugendstil* in Germany and Austria, and *Stile Liberty* in Italy, named after Liberty's shop in England.

[2] The actual originator of the movement is not very apparent. Nikolaus Pevsner (*Pioneers of the Modern Movement*, London, 1936, p. 99 et seq.) gives first prominence to Horta, although he acknowledges Van de Velde's contributions. Walter Curt Behrendt in his accounts of *L'Art Nouveau in Modern Building* (London, 1937) does not even mention Horta.

[3] Op. cit., pp. 224, 225.

Renaissance art, and is really a late development of the Pre-Raphaelite movement. In turning to early Italian painters for inspiration the Pre-Raphaelites inevitably became aware of the decorative value of linear rhythms apparent in early Sienese painters like Duccio and Simone Martini, and in later Florentine painters like Fra Filippo Lippi, in whose pupil, Botticelli, linear rhythms became an important decorative aim, associated, it must be remembered, with the development in Florentine painting to express movement. In those reliefs of the fifteenth-century sculptor, Agostino di Duccio, which represent angels playing musical instruments, there is clearly an attempt to express musical rhythms in the lines of the angels' draperies, and these rhythms are as extravagant as any in Renaissance art. In looking at Rossetti's early work we are conscious of earlier influences than Botticelli's; we think more of Fra Filippo Lippi and Benozzo Gozzoli; but there is no doubt that Burne-Jones evolved his linear patterns under the spell of Botticelli. Also the Pre-Raphaelites were greatly influenced by the drawings of William Blake, where line is used almost as rhythmically as in Botticelli's work. The source of Blake's art, however, is a subject of deeper speculation than can be considered here. The work of Rossetti and Burne-Jones led on to Aubrey Beardsley, while the Pre-Raphaelite influence in many German, Belgian, and Dutch artists like Ferdinand Hodler, Fernand Khnooff, and Jan Toorop, in which the use of line as a major motif in design, may have provided one of the origins of *L'Art Nouveau.* As an example of the influence of the Pre-Raphaelites on the Continent it is interesting to look at a decoration by Otto Eckmann of a page of the magazine *Pan,*[1] which has a head after Rossetti and leaf decoration after Morris. If Eckmann did not know the work of Rossetti and Morris his decorations represent a remarkable artistic parallel.

It must be remembered that, at this time, music was exerting some influence on the sister art of painting, as may be seen in the work of Whistler, where tones and colours were related and pictures were conceived very much under the influence of thought in terms of music. Music also clearly had some influence on the rhythms in Rossetti's and Burne-Jones's pictures —how often are dreamy women depicted playing musical instruments. In a picture like Rossetti's *The Bower Maiden,* it is not only the dance but the all-pervading music which influences the rhythms.

The authors of *L'Art Nouveau,* although striving for a style which should be new and not dependent on the past, expressed very much the spirit of the time. Yet, like all new movements, it was dependent partially on the

[1] Reproduced in Pevsner's *Pioneers of the Modern Movement,* p. 112.

past. *L'Art Nouveau* spread from Brussels to other parts of Europe. One expression in England which had more the character of an adopted artificial form of decoration imported from Belgium as distinct from its direct evolution from Rossetti, Burne-Jones, and Beardsley, is in the decorations to the Cranston tea-rooms at Buchanan Street, Glasgow, in 1897, by C. R. Mackintosh and George Walton. In the three subsequent Cranston tea-rooms the linear character of the decoration is not so pronounced. In Mackintosh's other decorative work the liking for fanciful line is apparent, and this influence may have been responsible for Mackintosh's exaggeration of verticals in backs of chairs and in the linear emphasis of structural members in the Glasgow School of Art.

L'Art Nouveau was a strong influence in Vienna and among the artists of the 'Viennese Sezession'. It first manifested about 1898 in the decorative work of Otto Eckmann and Hermann Obrist. In Germany its chief representative, apart from the later influence of Van de Velde, is in the work of August Endell, who decorated the façade of the Elvira Studio (1897) with a curly dragon and curled window-bars. In the work of these Viennese and German decorators there was not quite the same liking for abstract line as in the work of Horta or even in the work of Mackintosh. There was more generally a desire to associate it with natural forms. This may have been due to the influence of Van de Velde.

It is in the work of Van de Velde that one of the principal contributions of *L'Art Nouveau* to architecture probably emerges. Since the publication of Darwin's *Origin of Species* in 1859, theories of evolution and of the development of organic life were more and more influencing European thought, and it had some influence on thinking architects, among whom were Gottfried Semper, the German architect, and Van de Velde, who expressed his indebtedness to Semper's teaching.[1] Van de Velde tries to associate the linear rhythms of *L'Art Nouveau* with structure, and he tried to think of rhythmical lines as lines of force. Thus in the furniture and decorations he designed for his house at Uccle, the tables and chairs all have curved supports, and staircase balustrades he made curved instead of straight. A later work, the Theatre, which he designed for the Cologne Exhibition of 1914, shows a similar predilection for curved forms.[2] He was fortified in this by the belief that organic forms are of this kind. In a way Van de Velde expressed in architecture and decoration what Van Gogh expressed in painting.

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[1] Mainly contained in *Der Stil in den technischen und tektonischen Kunsten* (Munich 1863).

[2] In this theatre Van de Velde eliminated the sharp separation between stage and auditorium that had become customary in theatre design, and conceived the whole as one room with the stage the same width as the auditorium.

From 1878 to 1886 Van Gogh was chiefly in Belgium and he exerted some influence on Belgian art of the nineties. In Van Gogh's painting there is apparent an intense apprehension of the life and colour of the natural world, of the growth of trees and flowers and grass, and of the shimmering atmosphere. It is this essential rhythmical life of the organic world that Van de Velde tries to incorporate into his designs of buildings and furnishings. From this there develops the idea of organic unity as a principle of architectural design which has been one of the principal creeds of some of the best modern architecture. Van de Velde's work and theories lead on to the work of Eric Mendelsohn, of whom Van de Velde is reported to have said: 'I have found a follower at last.'[1]

There was a parallel line of thought, with certain differences, in America in the theories and work of Louis Sullivan and Frank Lloyd Wright.

To those who contend that *L'Art Nouveau* died about 1905 having had little effect on the development of art and architecture it may be said that it played a part in leading to the German Expressionist school, which was probably one of the contributory causes of the Surrealist movement; that in its abstract forms, like Horta's decorations, it contributed to the development and encouragement of abstract painting of the twentieth century, and that it had some effect on the line of thought that led to the theory of organic unity in architecture. It contributed by its example to the formation of the Deutscher Werkbund in 1907, formed largely in protest against following historical styles in the production of objects of everyday use, and with a view to prompting the design of these objects in accordance with the needs of the time. Its founders were willing to use modern machinery for the purpose. This represented a reconciliation of art and the machine, more successful than anything Morris had achieved; but it must always be remembered that Morris in his maturer thought contended that machinery was to be accepted if it made men's lives easier, and that he was antagonistic to its improper use rather than to the machine itself. And it was Fischer's argument at the first meeting of the Deutscher Werkbund that it was our inability to use machines well that made machine work inferior. The example of the Deutscher Werkbund partially prompted the formation of the Design and Industries Association in 1915 but, more importantly, it led to Gropius's Bauhaus in 1923.

[1] Eric Mendelsohn himself told me this. These may not be the actual words, but I have reproduced the sense as I remember it.

CHAPTER VI

Towards Simplicity

ONE of the strongest and most widespread movements in the search for an architecture that should emerge from and express contemporary life was the somewhat negative movement towards simplicity. The movement was spreading at the end of the nineteenth century and was familiar in most European countries during the early years of the twentieth century. It was an attempt to purify architecture, to remove the accretions of style, to get back to simple and direct building so as to form a fresh starting-point for the architectural expression of the spiritual, social, and economic life of the time. It was a movement which manifested in most branches of architecture, in ecclesiastical, commercial, administrative, and domestic buildings. In industrial buildings its manifestation was less apparent, because such buildings in the nineteenth century, being more strictly utilitarian, were more generally examples of direct building for purpose without being designed in an historical style, and without stylistic ornament. I have noted in Chapter IV that in the early nineteenth century the really living architecture was found in factories and warehouses. We find, too, that progress in building construction and the more extensive use of new materials often develops sooner in industrial buildings than in other types. To these must be added buildings, like railway stations, where utility generally decisively overrides considerations of appearance.

It was in Holland and Austria that the early stages of the movement towards simplicity were most vigorous and produced the most outstanding results. A little later the movement appears with excellent examples in Germany and Sweden, and still later it spreads decisively over the whole of Europe, although the Mediterranean countries are the slowest to receive the influence.

This movement towards simplicity originates chiefly in the English school of domestic architecture from 1859 onwards, in which we find the return to simple, direct, honest building and the expressive use of materials, and with the work and example of the Dutch Gothic revivalist architect P. J. H. Cuypers, and with Otto Wagner in Vienna. Before Cuypers, who was active between 1850 and 1890, much Dutch architecture was of a very ornamental kind with stucco façades. Cuypers's Gothic was a simple type, but the value of his work lay chiefly in his uncovering the brick behind the stucco and using materials frankly and expressively. Cuypers's work led to a fresh valuation in Holland of the aesthetic claims of constructional materials. In the work of many Dutch architects of the early twentieth century there is a returning delight in brick—the traditional building material of the country—and in the plain brick wall. Some of the Dutch buildings, built between 1898 and 1917, in which this movement towards simplicity is apparent, are the New Exchange, Amsterdam, by H. P. Berlage, previously mentioned, the Headquarters of the Diamond Workers' Trade Union, Amsterdam (1900), also by Berlage; the Hotel American, Amsterdam (1900), by W. Kronnhout, which, though eclectic with a mixture of Romanesque, Gothic, and even Arabic elements, shows a distinct tendency towards broad treatment and general simplicity; the Barracks at Nymegen (1908), by J. Limburg, broad and simple in treatment with a dome suggesting slight Byzantine influence; the Observation House for children at Amsterdam (1910), by Jan de Meyer, symmetrical, simple, and restrained; and the Federation of Sailors' Building at Den Helder (1914), by P. Kramer, simple, massive, and square, in which there is a nice adjustment of horizontals and verticals. The blocks of flats, by M. de Klerk, built during his short career show this movement, each successive block or group becoming simpler than its predecessor. The Housing Blocks, built in 1913 and 1914, and the Post Office Housing Block, built in 1917, both at Amsterdam, are broad and simple in treatment, yet with numerous picturesque elements like odd curved-headed windows, circular projecting features, and decorative notes on the plain surface of the wall. M. de Klerk's post-war work, to which I will refer later, becomes simpler still with a very sparing use of those picturesque features which the average Dutchman finds it difficult to relinquish.

It is, however, the work of Berlage that had the greatest influence in Europe in the early years of the century, and it is very largely due to the Amsterdam Stock Exchange building (Plate XIII B and C). I have already referred to its plan, while it has an interesting iron and glass roof, but it is no less important as a building which is an early example of the sloughing of stylistic and ornamental accretions and of the use of the plain brick wall as an element in design. In the interior, flat, elliptical arches are supported by square, brick pillars, and stone blocks flush with the pillars serve as capitals. This illustrated part of Berlage's creed that 'we should show the naked wall in all its sleek beauty—pillars and columns should have no projecting capitals: the joint should be fused with the flat surface of the wall'.[1]

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[1] Berlage, *Gedanken über Stil in der Baukunst* (Leipzig, 1905), pp. 52–3, quoted by Siegfried Giedion (op. cit., p. 234).

The influence of this tendency in Dutch architecture is seen in Germany and Sweden. In the latter country there are considerable similarities with Dutch work, especially in the use of the plain brick walls, but there are usually Swedish traditional features which distinguish the buildings, such as the Baroque octagonal domed turrets and the onion domes. A good example of this tendency towards simplicity and the use of large expanses of plain brick wall is the Town Hall of Ostersund, designed by Wallberg, and completed in 1912 (Plate XIII A). It is a symmetrical building with projecting wings and a large central tower-like structure surmounted by an octagonal onion dome, and although there are small decorative features like small arched string-courses, the plain brick walls contribute much to the general effect. Another Swedish building, completed about the same time (1915), that provides a kindred example is the City Law Courts, at Stockholm, by Carl Westman (Plate XIV), which was probably partly inspired by the sixteenth-century castle of Vadstena and is symptomatic of the Swedish tendency prevalent at this time towards the perpetuation of traditional national architecture.[1] It is broadly and simply treated with large areas of plain brick wall and with decorative features and stone dressings appearing on a few focal points like the main entrance (Plate XIV). Sir Reginald Blomfield thought this building 'the finest piece of modern architecture in Stockholm'.[2] In his description of it he says that 'the tower rises sheer from the front wall of the building without that break forward which an ordinary designer would almost certainly have given it. The buildings terminate at either end in plain gable, there is no particular detail anywhere to arrest the eye, and I believe that it is this concentration on the essential qualities of architecture, the abstinence from irrelevant detail, the noble scale, and the deliberate austerity of the design that makes this building so impressive.' It will be seen later that work of a similar kind is continued to a greater extent in Sweden in the following twenty years.

The movement towards simplicity in England had, as before mentioned, begun with the domestic architecture of Philip Webb and Voysey and some of their followers. The first larger building, other than industrial, that shows a big step in this direction, in which historical styles are sloughed, is the Glasgow School of Art. In the early years of the twentieth century the tendency towards simplicity was spreading, although in the majority of buildings it was tentative with a not too courageous elimination of ornament. Among the buildings noteworthy for greater simplicity are those of H. Percy Adams and the architects associated with him. Adams shows an appreciation of the value of plain walls, whether stone or brick. Two good examples of his work, completed in 1906, are the Royal Victoria Infirmary, Newcastle-on-Tyne (in conjunction with W. Lister Newcombe), and the King Edward VII Sanatorium, Midhurst, Sussex. There are obvious differences in these buildings, the former has a restrained admixture of classical elements, while the latter is derived somewhat from seventeenth-century English domestic work, but they are both characterized by large, plain brick walls, the former with stone dressings. A slightly later work, which Adams designed in conjunction with Charles Holden in 1911, is the Bristol Royal Infirmary extension, which achieves a degree of simplicity that contemporary critics regarded as unpleasantly severe. It is a symmetrical design conceived in the classical spirit, while its plainness and its dependence for effect on the relations of plain blocks and masses represent a great step forward towards an architecture freed from historical styles and ornament (Plate XV).

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[1] I refer again to this building in Chapter XXIII.

[2] *Byways: Leaves from an Architect's Note-Book* (London 1929), p. 274.

Some mention has already been made of Otto Wagner. He made a vital contribution in this movement towards simplicity and a gradual releasing of buildings from the overlay of historical styles. As he develops from his traditionally Renaissance early work, his designs become simpler with less and less ornament, so that the classical columns with bases and capitals of a portico become simply plain, square shafts, as may be seen in the Stiftung Lupusheilstatte, Mittelbau (Plate XVI). As his book *Moderne Architektur* shows, he became interested in the geometrizing of architectural forms, and contended that all such forms should conform to geometric principles. He seemed to think that good proportion and great architecture could only come into being by conformity with geometric law, a creed that has had great influence in some modern European architectural developments. Otto Wagner's own work shows the steady tendency towards greater simplicity, the already mentioned Vienna Post Office Savings Bank and the flats in the Neustiftgasse, Vienna, being the best-known examples. The former, though broad and simple, still has traces of Renaissance influence in the grooved masonry, and in the application of sculpture; the same reminiscence remains with the latter, but here there is a more complete deletion of ornament. These buildings may or may not have been designed in accord with the geometric principals Wagner advocated. There is certainly good proportion in the buildings, and the windows are happily spaced on the façades.

Among the numerous architects whom Wagner influenced were many who continued this movement towards simplicity and who were influenced by his geometric theories. There is no doubt that when Joseph Hoffmann designed the Purkersdorff Sanatorium, in 1903, he was encouraged by the example of Wagner, for this building has plain stucco walls, unadorned window openings, and a purified appearance, that was not only rare at the time but reaches a degree of external simplicity that Wagner even did not achieve. This was Hoffmann's first important building (he was born in 1870), but it is not typical of his work. He had a liking for ornament, and the majority of his buildings display a free and original adaptation of the Renaissance style. The famous Palais Stoclet, in Brussels, built in 1906, has a certain kinship with the Purkersdorff Sanatorium, as it has large expanses of plain wall, but there are numerous ornamental features, and the tower is surmounted with elaborate sculptured ornaments. The design of the Purkersdorff Sanatorium was probably partially influenced by economic considerations, and by the utilitarian character of the building; nevertheless, it represents a considerable step towards the simple yet effective treatment of façades where artistic quality depends on the relation of square masses and on the spacing and proportions of the windows. In his later work, after the First World War, he occasionally returns to this early simplicity, but not with the same exclusiveness.

It is, however, to Adolf Loos, perhaps more than to any architect of the early twentieth century, that we owe the most outstanding advance in the direction of simplicity. It is not that he wanted to get rid of stylistic ornament so as to make a fresh start to achieve a living architecture, instead, the simplicity of his buildings, of the exteriors rather than the interiors, was due to his professed objection to ornament. His well-known passionate declaration in a Viennese café that 'ornament is a crime' is no exaggeration of his attitude, although it is not easy to reconcile this with many of his interiors and furnishings where certain ornamental features appear. These interiors, however, are very English in character, and demonstrate his great enthusiasm for English domestic architecture, principally that of Webb, Voysey, and their followers. It is possible, too, that his campaign against ornament may have been influenced by this English domestic architecture, for the exteriors of Voysey's houses are examples of a fine and tasteful simplicity. Loos[1] also felt that architecture should not be regarded so much as an art, but rather as the craft of building, and if ornament grew legitimately out of some types of building in the past, he failed to see how it could emerge from the modern architecture of steel and concrete where the machine plays an increasing part.

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[1] His opinions may be obtained from his book, *Ins Leere gesprochen* (Spoken into Space), a collection of essays.

Loos's early work consisted principally of houses, and we find that these were designed with severely plain walls and flat roofs and have generally a cubic appearance. His window openings are not formally and symmetrically placed unless this arrangement is as convenient as any other; in other words, convenience rather than symmetry or proportion determines their placing. A good example of one of his houses is that designed for Doctor Scheu, in Vienna in 1902. A certain irregularity can be noted in the placing of the windows, while at one side the house is set back story by story.

It is not apparent that Loos adopted geometric principles of design, like Wagner, but he probably influenced certain later movements in that direction. Contemporary with the early work of Loos was the cubist movement in painting. This probably originated with Cézanne, although Cézanne cannot himself be regarded as a cubist. Cézanne appeared to believe that the essential basis of all natural forms is geometric, for he contended that 'everything in nature is shaped according to the sphere, cone and cylinder'. The influence of Cézanne, especially after his death in 1906, was extensive and profound, and to many painters, in the two decades since his death, his sayings were rather in the nature of oracles. There is no doubt that his emphasis on the solidity of objects in his own paintings, and the influence of the saying quoted, were powerful contributory factors in the cubist movement, which may be said to have begun about the time of Cézanne's death. The movement displayed a tendency away from the depicture of natural forms and towards the conversion of these forms to geometric solids, or to abstract designs. The followers of the movement were able to elicit support from the Greek passion for geometry, and the belief held by many Greeks that geometric forms were the essential basis of all natural forms, and that the pattern of the universe was a geometric one. Further, Plato's suggestion in the Philebus that geometric forms have an absolute beauty gave additional support. 'I mean', says Socrates, 'that straight lines and curves and the surfaces or solid forms produced out of these by lathes and rulers and squares . . . that these things are not beautiful relatively, like other things, but always, and naturally and absolutely.'[1] This theory of absolute beauty for geometric forms is certainly a great encouragement to cubists and those who design according to geometric law. But the theory of absolute beauty for anything is untenable, as I hope to demonstrate later when considering more recent architectural developments.

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[1] Translated by E. F. Carritt, *Philosophies of Beauty* (Oxford, 1931), p. 30.

I have glanced briefly at cubism because it and the geometric theories that brought it into being have some influence on modern European architecture. Adolf Loos did not design according to geometric principles, but his simple box-like cubic exteriors were contemporary with cubism in painting, and he provided examples to Le Corbusier, who was clearly influenced both by Loos and cubism, and who seems to believe in the absolute right and beauty of design that conforms to geometric law. In 1915 Le Corbusier made a sketch in which terrace houses are grouped on three sides of a square, designed with flat roof and general square effect, the influence of cubes being apparent, and the result is not unlike a simplified version of English Georgian architecture. But this geometric tendency, with which I will deal more fully later when considering Le Corbusier's work, is governed by the conviction that all great architecture and design are based on geometric law. Such a movement is assisted in its initial stages by the general movement towards simplicity which had exercised some influence on most European architecture by 1914, and which, by getting rid of past styles, was certainly an important contribution towards an architecture emerging directly from contemporary life.

CHAPTER VII

Iron Construction—Early Bridges, Roofs, and Factories, 1772–1859

UP to the end of the eighteenth century the chief constructional materials used for building in Europe were stone, brick, and wood. In ancient Greece and Rome structure was based on stone and brick supporting walls, and on Greek post and beam and Roman arch and vault construction. In Romanesque architecture, and later in Renaissance architecture, these methods were continued; but in Gothic churches the solid Romanesque walls had been pierced by large windows, the heavy solid buttresses had been similarly pierced and lightened, and thus emerged the stone-framed construction. Wood was employed for framed roof structures for Greek and Roman temples and other buildings, and for Gothic buildings. In medieval houses there was, in addition to the wood-framed roofs, a considerable amount of wood-framed construction in the walls, the spaces between the framework being filled with clay and straw stuck on laths and faced with plaster. This half-timber work achieved a picturesque appearance which has been much imitated by shams in modern domestic building. The only occasion when iron was used, other than as small fittings, was for chains encircling domes to counteract the outward thrusts, the two most noteworthy examples being the domes of St. Peter's and St. Paul's Cathedrals.

With the Industrial Revolution iron began to be used as a constructional material in building, at first to a very limited extent, but more and more as its possibilities were realized, so that by 1914, after its conversion to steel, it was an important structural material in most large buildings erected in Europe. Iron had been known, used, and worked since the dawn of history, but never before the end of the eighteenth century had it been used on a big scale or in large parts for building. The means to produce large pieces of iron in considerable quantities had not been available, although the desire had often existed. We know, for example, that in 1755 there had been a project to build an iron bridge across the Rhône, but it had to be abandoned because it was impossible to cast the iron in pieces of adequate dimensions. It was by the use of coal and the blast furnace in smelting, that iron could be produced in great quantities and be cast to increasing dimensions, thus opening to the world a new industrial era. What had been attempted in France in 1755 was realized in England by 1779. In that year an iron bridge over the Severn was completed at Coalbrookdale, in Shropshire. It still remains, being now used as a footbridge. It has a span of 100½ feet, and consists of five semicircular ribs, each being cast in two pieces. Simple as is the bridge it is not without beauty (Plate XVII). Some uncertainty seems to exist as to who really designed this bridge, writers ascribing it to different engineers.[1] Sir William Fairbairn[2] quotes Tredgold as saying that 'the idea appears to have originated in the year 1772, with the late Thomas Farnolls Pritchard, then of Eyton Turret, Shropshire, architect, who, in communication with the late Mr. John Wilkinson, of Brosely and Castlehead, ironmonger, suggested the practicability of constructing wide iron arches capable of admitting the passage of a river such as the Severn, which is much subject to floods. This suggestion Mr. Wilkinson considered with great attention, and at length carried into execution between Madeley and Brosely, by erecting the celebrated iron bridge at Coalbrookdale, which was the first construction of that kind in England and probably in the world. This bridge was executed by a Mr. Onions, with some variations from Mr. Pritchard's plan, under the auspices and at the expense of Mr. Darby and Mr. Reynolds, of the ironworks at Coalbrookdale.'

The second cast-iron bridge was built to cross the Wear, at Sunderland, in 1793, and was a more ambitious undertaking. The span is 240 feet. It is generally ascribed to Roland Burdon, but Siegfried Giedion,[3] following Richard Blunck,[4] contends that in the method of construction Burdon appropriated the patents of the American, Thomas Paine. The bridge is interesting because stone construction is imitated in iron. It consists of six ribs 6 feet apart, and between each rib are 105 perforated blocks of iron, in imitation of radiating stone voussoirs, held together with wrought-iron arcs, fitting in grooves and secured by bolts. It is another example of the inevitable tendency, seen in all kinds of construction, that when a new material is employed the method of construction of the old material is to some extent followed, and it is only after much experience of the new material that the forms emerging from its capacities are evolved, thus moving more and more away from the shapes of the old material.

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[1] Siegfried Giedion (op. cit., p. 105) ascribes the idea to John Wilkinson; P. Morton Shand (*Architectural Review*, Nov. 1932) to Roland Burdon; and Walter Goodsmith (*Architectural Review*, Nov. 1932) to Thomas Farrolls Pritchard. P. Morton Shand appears to have confused the bridges at Coalbrookdale and Sunderland, because Roland Burdon is generally regarded as having been responsible for the latter.

[2] *On the Application of Cast and Wrought Iron to Building Purposes* (London, 1854), p. 2.

[3] Op. cit., p. 106.

[4] *Thomas Paine* (Berlin, 1936), p. 115 et seq.

In 1801 Telford and Douglas designed a new London Bridge in iron with a single span of 600 feet at a height of 65 feet above high-water level. This ambitious design was considered by a select committee of Parliament. The committee was in favour of erecting the bridge, but it referred the project to a number of experts who were also mainly, though not unanimously, in favour of its erection. Although the existing London Bridge, by Rennie, is beautiful, one cannot help regretting that this dramatic and courageous iron bridge by Telford and Douglas was never built. Judging by the drawings which remain it was certainly a beautiful design with its magnificent sweep of one span (Plate XV). The great value of a bridge with one span with a height of 65 feet was that it would permit the passage of larger ships, and the committee spoke of the 'obvious advantages which would be obtained if the communication could be effected by means of a single arch'. It also referred to the 'magnificence of the proposed structure'.

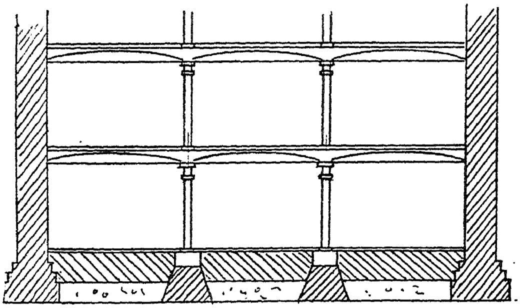
From the early part of the nineteenth century iron construction for bridges gradually replaced stone and brick construction. The suspension bridge was an early type, employed especially for wide spans; Telford's Menai Straits bridge, with a span of 579 feet, built in 1818; Marc Sequin's bridge over the Rhône, near Tournon, with two spans of about 280 feet each built in 1824; the younger Brunel's Clifton bridge, with a span of 702 feet, designed in 1832 (but not completed until 1864), being among the famous early examples.

Most of the earliest examples in England were built of cast iron. After the Vauxhall Bridge, built by James Walker in 1816, which was the first iron bridge to cross the Thames, and Rennie's Southwark Bridge, built in 1819, both now replaced, iron bridges became fairly common, the advent of railways acting as a great stimulus. The first railway bridge, and the first to be constructed mainly of wrought iron, was the bridge over the river Gaunless, at West Auckland, to carry the Stockton and Darlington railway. Built in 1824 by George Stephenson, it was 50 feet long with four spans of 12 feet 6 inches each, not a very ambitious design even for 1824. The three middle supports are essentially trestles, and it was the first of the many railway trestle bridges built. Robert Stephenson, his son, made a great contribution to bridge-building and it was he who made considerable progress in the use of the iron girder for the purpose. His best-known work is the Britannia Bridge over the Menai Straits, built in 1852. It is built in the form of two iron tubes side by side, constructed of wrought-iron plates riveted together with criss-cross iron tubes at the floor and roof. It has four spans, the two centre being 460 feet, the two outer 230 feet, the bridge being supported on masonry piers. The design has been adopted for many subsequent bridges, more in other countries than in England.

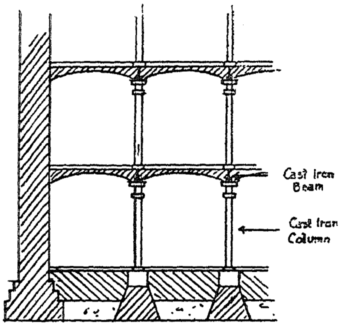
Brunel's Royal Albert Bridge, Saltash, completed in 1859, shows some interesting constructional developments (Plate XXIV). The two main spans over the River Tamar are each 455 feet. The centre pier consists of four cast-iron columns on a stone plinth, while the other piers are of masonry. Each of the two main spans consists of a large wrought-iron tube elliptical in section, 16 feet 9 inches wide by 12 feet 3 inches high, taking the form of a flat arch. Suspended to this are two flat linked chains, and hanging from the tube are eleven pairs of vertical standards connected by diagonal bars, to which the track girders are attached. It is really a combination of the bowspring and suspension types, the arch tubes forming the bowspring, the chains the suspension. The main weight is taken by the bowspring, and the chains are accessories. As will be seen from the illustration of the bridge in course of erection, the whole thing was first constructed on a pontoon and then raised in position. What is particularly interesting is the use of large tubular iron. The weight of solid iron of such a size would have made the construction impossible. Tubular iron, while being comparatively light, is also very strong. It was used in later bridges, the great Forth Bridge being a noteworthy example.

Iron was first used in buildings as a frame to roofs, and as supporting columns and beams in factories. The earliest examples of its use in roof construction was in the roof of the Théâtre Française, built in 1786 by Victor Lewis. Hitherto, roofs of this kind had been constructed with wooden ribs but they were often damaged or destroyed by fire. The roof of the Théâtre Française was of wrought-iron ribs, and considering that it was the first roof of this material its construction was remarkably light and daring. In 1782 the Paris Corn Market, which had a cupola of wood, was destroyed by fire. It was rebuilt in 1811 with a cupola of copper and iron, the work of the architect Bellangé and the engineer Brunet. This was the first time in which an architect and engineer were engaged together on a building, and with the introduction of iron construction this practice has continued to a considerable extent ever since. Some regarded it as a regrettable development. It is presumed that the engineer is responsible for the construction, and the architect for the design of the building and its aesthetic effect. In some buildings and structures there has been no such collaboration, the architect or the engineer being wholly responsible, but with the introduction of iron and steel construction in public and commercial buildings there has generally been such collaboration, and in the case of much more strictly engineering works, such as bridges, it is becoming customary to employ an architect as well. Those who object to this collaboration say that the construction is so closely connected with design and determines so much the character of a building that it should be the product of one mind. It is contended that the man who designs a building should understand thoroughly the possibilities and nature of the construction to be employed. Certainly in numerous cases it has hardly been collaboration, instead the engineer and architect have been bent on their different purposes, so that there has resulted incongruity in the work of the engineer and architect. In the nineteenth century the engineer has been mainly concerned with using iron, steel, and concrete in accordance with their structural capacities, and he has been interested to develop such construction. At the same time the engineer of the nineteenth century has shown that he has aesthetic feeling for his structures which have often clearly been partially determined by artistic considerations, so that some of the most beautiful architectural works of the nineteenth century have been the works of engineers. I am convinced that many engineers thought of the beautiful appearance of their structures, and to some extent designed them accordingly, although such intention may often have been partly subconscious or if conscious they did not talk much about it. But when there was collaboration with an architect, the architect was often almost solely interested in producing pleasing façades in some ancient style—Greek, Romanesque, Byzantine, Gothic—and there has been no harmony between the purposes of the engineer and the architect. The engineer was concerned with beauty that emerged from a modern method of construction, the architect with imitating a beauty that had been created by a people remote from contemporary life. A vivid contrast of this kind is St. Pancras Station. A progressive creation of contemporary engineering emerging from the needs of the time contrasts with an adjoining hotel and offices dressed in a style expressing a totally different civilization. There is no expression of the purpose of the hotel with offices in its appearance nor does it appear to express contemporary life; it appears rather as clothed in some historical fancy dress.

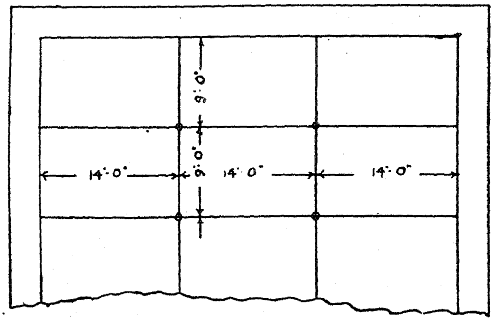
Hollow cast-iron columns were used as supports in the latter part of the eighteenth century. An early example is in a bookshop in Finsbury Square, London, called Lackingtons' 'Temple of the Muses', built in 1794; and cast-iron columns appeared a little later in curious guises in the Royal Pavilion at Brighton, designed by John Nash in 1816. They are ornamental but restrained in the red drawing-room, but burst out as palm-trees in the kitchen. In cotton mills in Lancashire cast-iron columns were used as



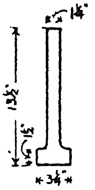
TRANSVERSE SECTION



LONGTITUDINAL SECTION



PLAN



SECTION OF CAST IRON BEAM

FOUR DIAGRAMS ILLUSTRATING A CAST-IRON COLUMN AND BEAM CONSTRUCTION OF A COTTON-MILL, BUILT IN SALFORD IN 1801. DESIGNED BY BOULTON AND WATT.

THE DIAGRAM ON RIGHT SHOWS THE CONSTRUCTION OF CAST-IRON COLUMNS AND BEAMS, ETC., IN FACTORY BUILT BY SIR WILLIAM FAIRBAIRN (1845)

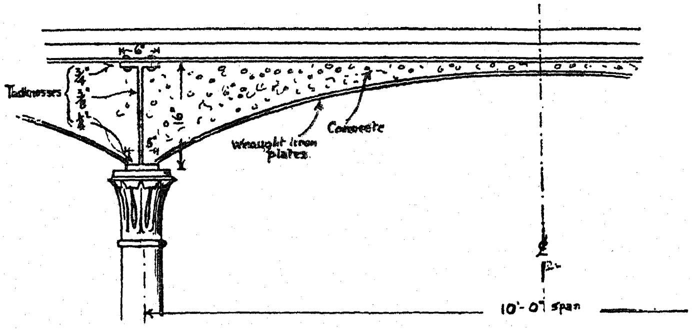


PLATE XVIII

supports to wooden beams and in 1801 cast-iron beams were used in a cotton mill erected in Salford for Phillips & Lee of Manchester. Sir William Fairbairn said of this that it was 'the first instance on record of the successful application of cast-iron beams to the purposes of building'. The iron beams and columns were designed by Boulton and Watt.[1] The section of the beam is illustrated (Plate XVIII) and it will be noted that it has a small flange at the bottom. The mill was a seven-story building 140 feet long and 42 feet wide. The iron beams were erected across the building from wall to wall at intervals of 9 feet, and lengthwise at intervals of 14 feet. Between the beams supporting the floors were brick arches 9 inches deep at the spring and 4½ inches in the centre.

This method of construction was employed for a few cotton mills from 1801 until 1827. No improvement seems to have been made during this period. Its great interest for us is that it is the first step towards the modern steel frame. From 1827 onwards improvements take place from time to time, due in the mid-nineteenth century very largely to Hodgkinson's experiments. These experiments were mainly directed to increasing the strength of the beams. First the bottom flange was enlarged, then a top flange was added, and there were continual experiments with the thickness of the various parts. In 1845 wrought-iron beams began to be used. A refinery, designed by Sir William Fairbairn in that year, shows an interesting development in floor construction. The wrought-iron beam resting on the cast-iron column has a double flange. The beam is ⅜ inch thick, the bottom flange ½ inch and the top flange ¾ inch. The distance between columns is 10 feet, and instead of a brick arch, wrought-iron plates are bent in the form of this segmental arch, and the space is filled with concrete (Plate XVIII). A similar method of construction was adopted for the famous Saltaire Mills, erected by Lockwood and Mawson for Sir Titus Salt. When the main factory building was completed in 1853, it was probably the largest in existence. It is a four-story building 550 feet long and 50 feet wide. There is a central archway on the ground floor above which, on the first and second floors, is a central engine house. But in the top floor the room extends the whole length of the 550 feet. It was claimed at the time that this was the largest room in the world. The ground story is 16 feet from floor to floor, and the upper stories 14 feet. The floors were supported by iron beams resting on iron columns, with flat segmental brick arches between the beams, in the manner of earlier constructions. The rooms are warmed by steampipes, and the ventilation is ensured by flues in the walls, the method being an innovation at the time of its construction. The factory, like the rest of Saltaire, is built with exterior walls of stone, dressed in the Italian Renaissance style, some of the chimneys even being somewhat like Italian campanili.

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[1] William Fairbairn, *On the Application of Cast- and Wrought-Iron to Building Purposes* (London, 1854), p. 3.

Though the iron column and beam construction was the beginning of the iron frame, in these early buildings it was only an iron frame between walls, which were of solid brick or stone and which did not form part of the iron frame. The early developments in which the whole building was an iron frame, with the exterior walls no longer supporting members, took place in the United States from 1848, with the pioneer work of James Bogardus. It is outside the scope of this history, but it is dealt with in many American works and by Siegfried Giedion in *Space, Time and Architecture* (pp. 129–38).

In Europe the earliest complete iron frame buildings seem to be some model houses shown at the Paris Exhibition of 1867, but I am unaware whether any were built according to these models. Failing the existence of any of these, the earliest actual iron-framed building was the Menier Chocolate Factory at Noisiel-sur-Marne, built in 1871, but before dealing with these it is important to glance at the development of iron and glass roofs and of the iron and glass construction of markets, exhibition buildings, and railway stations, as they are themselves iron frame constructions without the covering of stone or brick.

Early developments of iron and glass roofs took place mainly in France. Between 1823 and 1833 the iron and glass cupola of the Chamber of Deputies was built; and Fontaine's Galerie d'Orléans, built 1829–31, led the way to the construction of the numerous semicircular glass roofs that became familiar in Europe in arcades, exhibition halls, and railway-stations. The Galerie D'Orléans no longer remains, being destroyed in 1935 when the Palais-Royal was remodelled. It was a long arcade with shops on either side (Plate XVII). The type became familiar in most European cities, the largest and most impressive being the Galleria Vittorio Emmanuele, in Milan, built in 1865–7, which is clearly influenced in design by the Galerie D'Orléans.

In 1824 the Market Hall of the Madeleine was built by Veuqny, and it is conspicuous for its daring lightness. Not quite so light, but interesting in another respect, is the Hungerford Fish Market in London, built in 1835. The interesting feature here is that although it has a span of 32 feet between the columns there is no tie or lateral support in the roof. In 1833 Rouhault's conservatory of iron and glass was built in the Jardin des Plantes in Paris.

Nothing on such a big scale constructed completely of iron and glass had been built before. It consists of two quarter-circle vaults, one perched on the other, extending on either side of two rectangular central pavilions. Each of the barrel-vaulted wings is about 203 feet long, about 23 feet wide, and about 16 feet high. Joseph Paxton was at this time building greenhouses in England, and he made them with wooden ribs. For many years greenhouses had been constructed with bulky timber framework and small panes of glass. Paxton had lightened the framework and increased the size of the panes of glass, and had introduced methods of slotting the window bars. Paxton had obviously considered iron framing, but he preferred timber because it was considerably cheaper. In 1834, however, Paxton visited Paris and probably saw Rouhault's conservatory in the Jardin des Plantes, for a little later (1837–40) Paxton built the great conservatory at Chatsworth with iron ribs, and of a design which has certain affinities with Rouhault's work. For building this conservatory Paxton had invented a machine for making the window bars rapidly and economically. The Palm House at Kew, begun in 1842 and completed in 1866 and designed by Richard Turner and Decimus Burton is very similar in design to Paxton's conservatory at Chatsworth.

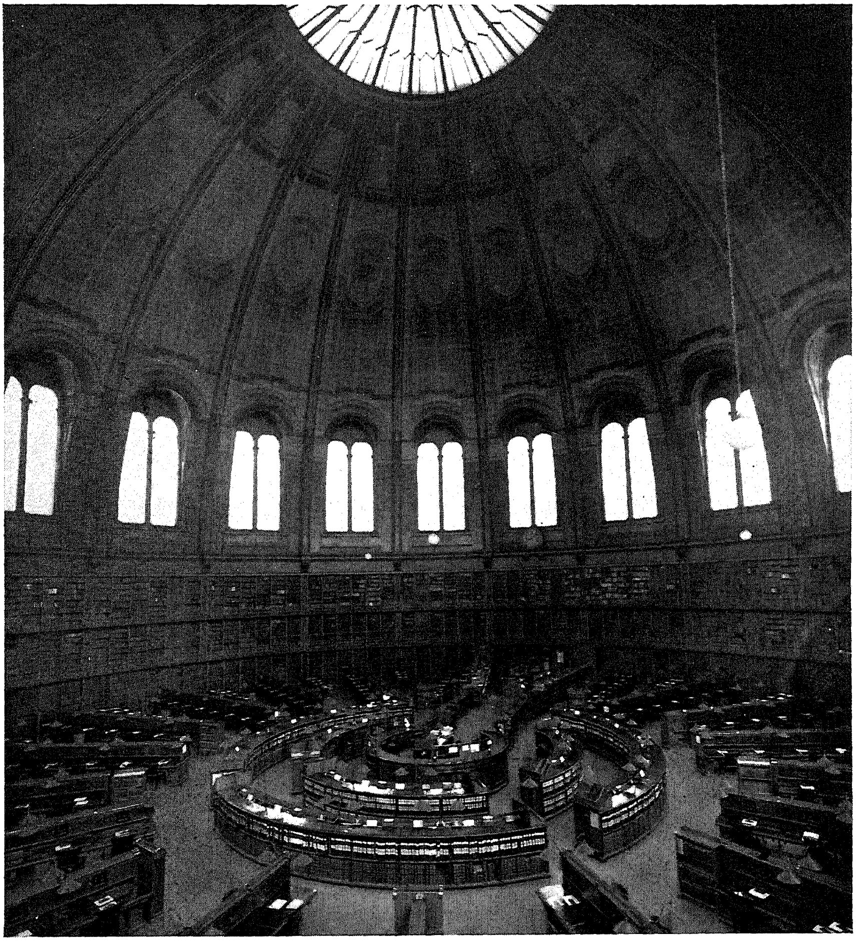
A particularly important building in the evolution of construction is the Bibliothèque Sainte-Geneviève, in Paris, designed by Henri Labrouste in 1843. I have already dealt with the plan of this building (Chapter IV). Its construction is similar in one respect to that which we have noted in the cotton mills, being an iron construction within enclosing stone walls. It comprises two arcades with semicircular iron roofs divided by a row of iron columns and arches (Plate XVII). Its connexion with cotton mills on the one hand and with the Galerie D'Orléans on the other is apparent. Between the building of Labrouste's Bibliothèque Sainte-Geneviève and his second great work of this kind, the Bibliothèque Nationale (1858–68), the British Museum was built with its impressive reading-room completed in 1857. The vast dome of this reading-room, designed by Sydney Smirke in collaboration with the librarian Sir Anthony Panizzi, was constructed of iron ribs which radiate to the large glazed disk at the summit (Plate XIX A). The windows between are of an Italian Renaissance design. The whole effect of a large circular room with a dome above and with a general movement of radiating desks and arched ribs towards the centre is magnificent. The features are felicitously proportioned, the radiating ribs help to carry the eyes upwards to the apex of the dome, and one is aware of an impressive feeling of space. The dome is 140 feet in diameter, 32 feet more than that of

St. Paul's and more by 2 feet than that of St. Peter's, being only about 2 feet less than the dome of the Pantheon, and thus the second largest in the world at the time of its erection. This was accomplished after little more than half a century of iron roof construction. What possibilities it holds for the future!

It must not be thought that so magnificent and impressive a reading-room, stimulating a sense of space, is distracting to readers. On the contrary many habitual readers testify that there is an agreeable sense of peace, and the atmosphere is conducive to study. I can add to that testimony. At the same time, whilst waiting for books which are often a long time coming, I have derived a partly subconscious pleasure from looking into the space of the dome, my thoughts seeming sometimes to be given wings.

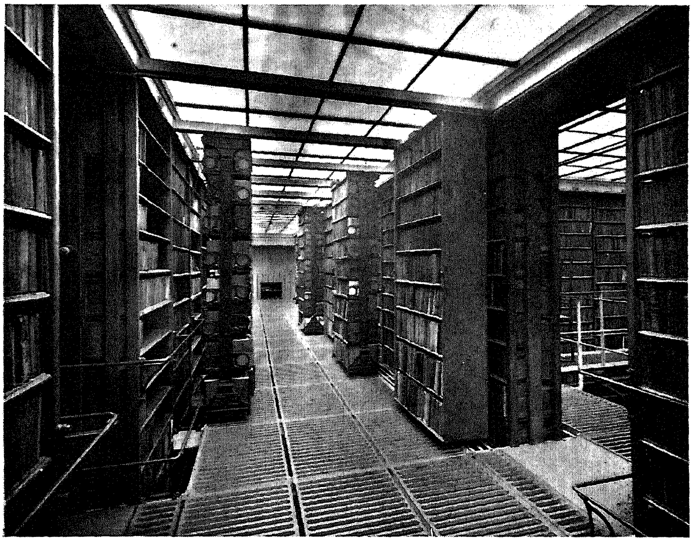
The stacks for books that surround the reading-room (Plate XIX B) are constructed mainly of iron columns and beams, and of iron floor plates separated in gridiron fashion, thus allowing free play of light from the glass roof at the top to the bottom floor, for when it was built there was no artificial lighting in the stacks. The gridiron was convenient for the presses for additional books, for these presses were suspended by wheels on rails and could be moved out as required. Occupying the quadrangle of the Museum building the circular reading-room left the corners of the square to be filled out by the stacks.

The design and construction of these book stacks was largely followed by Labrouste in the Bibliothèque Nationale. The reading-room of the Bibliothèque Nationale follows the principle of the Bibliothèque Sainte-Geneviève, being an iron construction within the exterior stone walls. Nine cupolas on spherical vaults are supported on semicircular girders resting on tall, slender, cast-iron columns. Both from the standpoint of planning and construction, with which I have previously dealt, the Bibliothèque Nationale is one of the most progressive achievements of the middle of the nineteenth century.



A

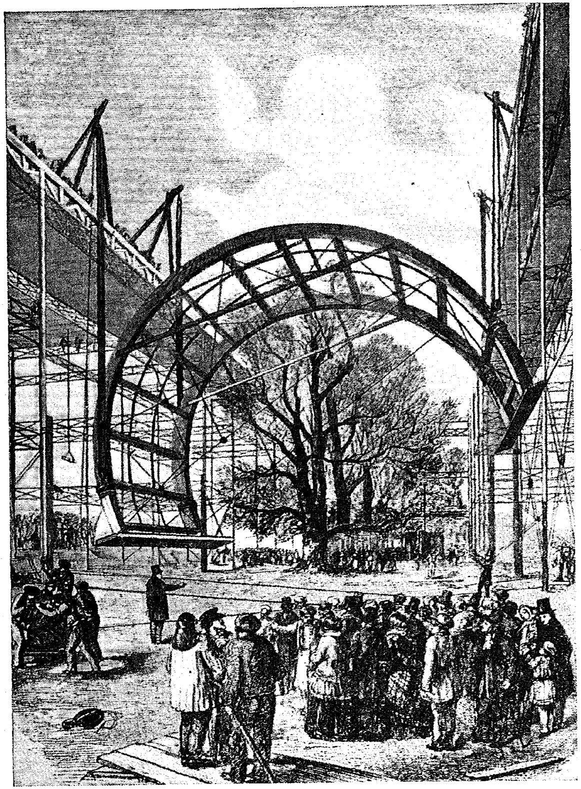
B



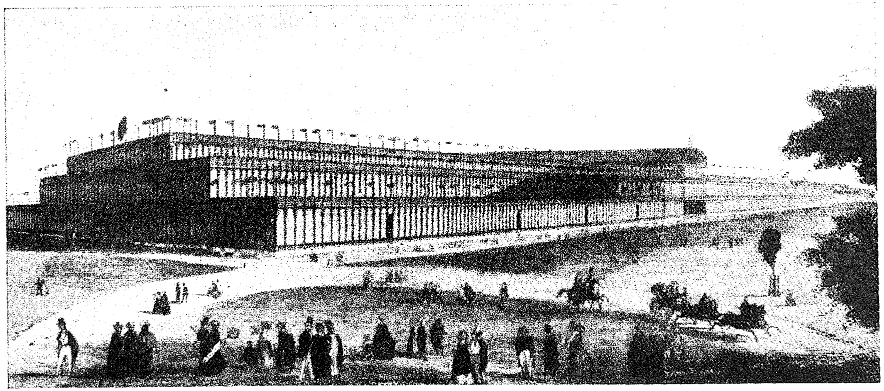
A. THE BRITISH MUSEUM READING ROOM, DESIGNED BY SYDNEY SMIRKE, IN COLLABORATION WITH THE LIBRARIAN, SIR ANTHONY PANIZZI (COMPLETED 1857)

B. THE LIBRARY BOOK STACKS

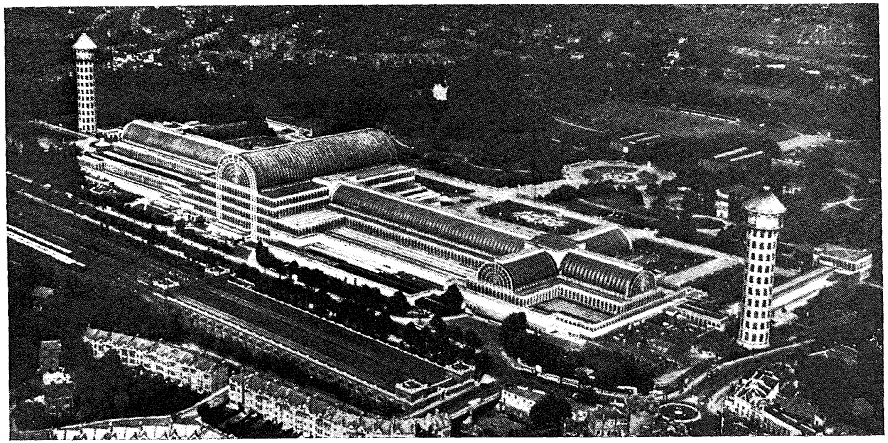
PLATE XIX



HOISTING ONE OF THE WOODEN ARCHES INTO POSITION
(*Illustration by courtesy of* ILLUSTRATED LONDON NEWS)



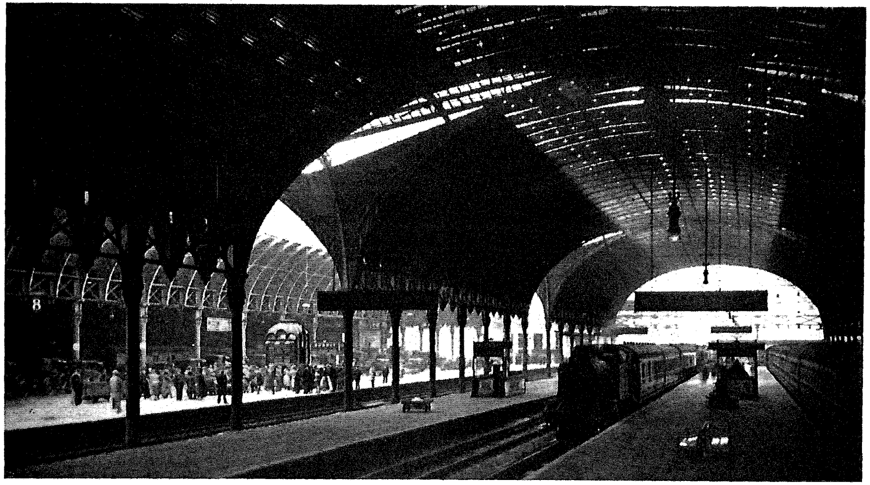
AN ENGRAVING OF THE BUILDING AS ORIGINALLY ERECTED IN 1851 AS THE EXHIBITION BUILDING IN HYDE PARK



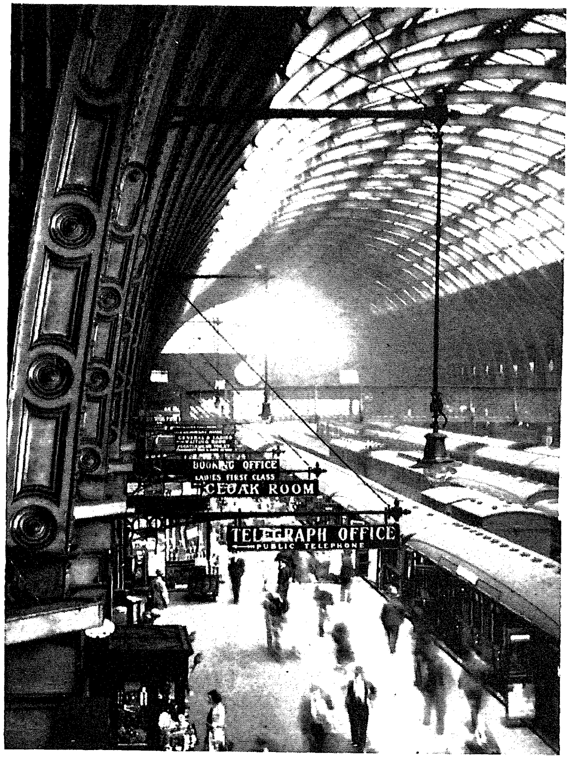
AN AERIAL VIEW OF THE CRYSTAL PALACE AS REBUILT AT SYDENHAM IN 1853. IT WAS DESTROYED BY FIRE IN 1936

THE CRYSTAL PALACE, DESIGNED BY JOSEPH PAXTON

PLATE XX



A



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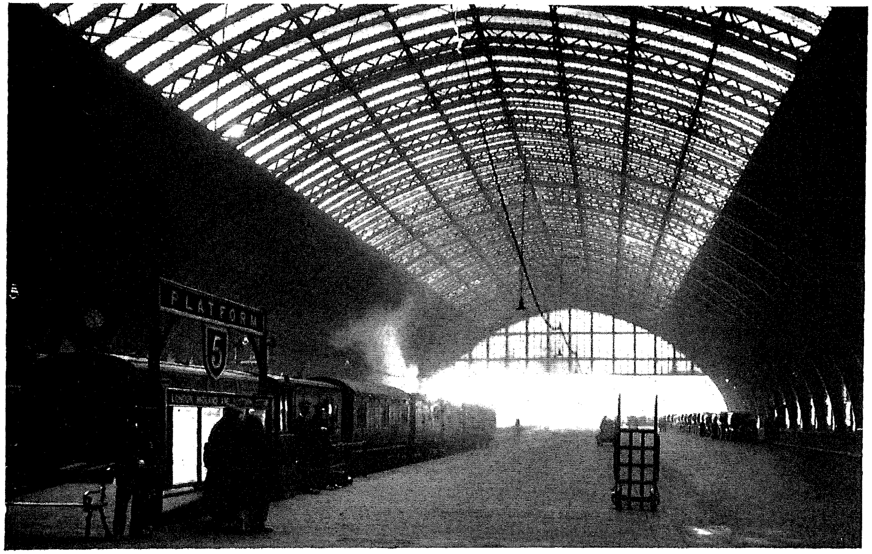


B

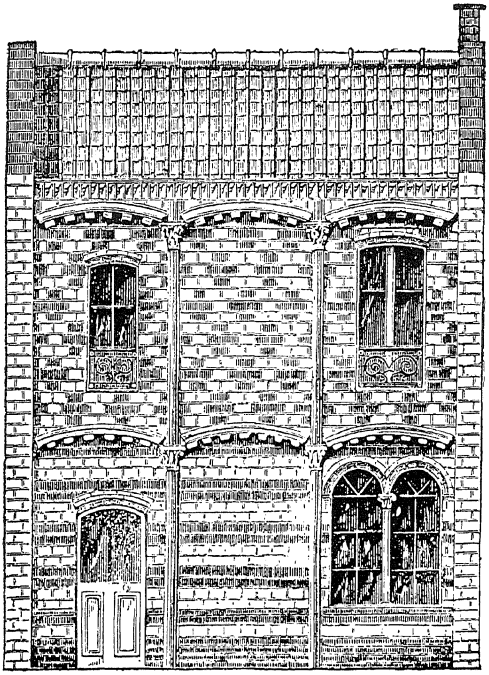
A. PADDINGTON, DESIGNED BY BRUNEL (1854)

B. ST. PANCRAS STATION, BUILT BY P. W. BARLOW IN 1868

C. KING'S CROSS, DESIGNED BY LEWIS CUBITT (1852)

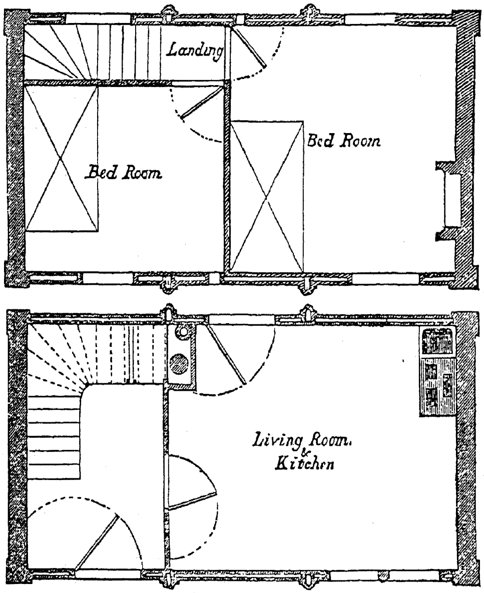
RAILWAY STATIONS

PLATE XXI



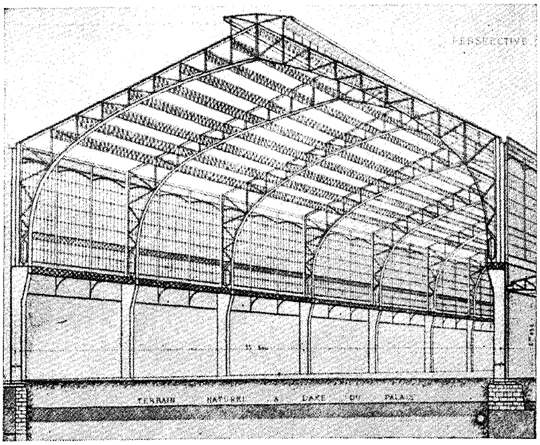
ELEVATION OF A 3000-FRANC HOUSE.

ELEVATION OF IRON-FRAME HOUSE WITH HOLLOW-BRICK WALLS, EXHIBITED IN THE PARIS EXHIBITION OF 1867
Architect: M. S. FERRAND

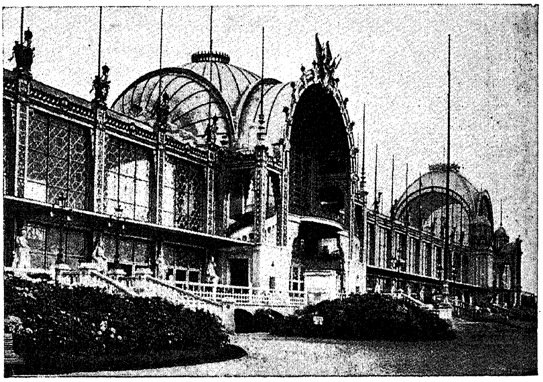


GROUND FLOOR
PLANS OF A 3000-FRANC HOUSE.

PLANS OF THE SAME BUILDING



FRAMEWORK OF THE GALERIE DES MACHINES AT THE PARIS INTERNATIONAL EXHIBITION OF 1878
Engineer: HENRI DE LION



TWO VESTIBULE BUILDINGS OF THE PARIS EXHIBITION OF 1878, DESIGNED BY GUSTAVE EIFFEL

PLATE XXII

CHAPTER VIII

Iron and Glass Exhibition Buildings, 1850–78

IN 1850 designs were invited from all countries for a great exhibition building to be erected in Hyde Park. Two hundred and thirty-three designs were submitted but none was adopted, although Hector Horeau was awarded first prize. This architect seemed destined to produce designs that never materialized. He had already produced an interesting design for the new market hall in Paris, but the work was given to Victor Baltard, who originally built a stone hall, which was destroyed by order of Haussmann, and the present iron and glass structure replaced it in 1853, also designed by Baltard. After the competition for the Hyde Park exhibition building Paxton produced a design in nine days and was given the work, the contractors being Fox, Henderson & Co.

The Hyde Park Exhibition building was commenced on 26 September 1850 and the structure was practically completed by 14 January 1851, a period of less than four months. None can deny that this was one of the most remarkable achievements in the history of building. The possibilities that it held for the future were fully realized by M. D. Wyatt, one of the supervisory engineers. He contrasts the construction with that of a large stone building like St. Paul's Cathedral. Looking back in retrospect it is possible to enlarge and extend the significance of Wyatt's comments.

St. Paul's Cathedral occupies an area of 55,000 square feet, the Crystal Palace 772,784 square feet. St. Paul's Cathedral took thirty-five years to build, the Crystal Palace about sixteen weeks. The walls of St. Paul's are 14 feet thick, those of the Crystal Palace 8 inches. How was the erection of such a vast building in so short a time possible? The reason is that units of wood, glass, and iron of a size not hitherto employed were manufactured to standard sizes and assembled on the site—units such as standardized cast-iron sections, glass panes made to a greater size than ever before, and wooden arches made in large sections and hoisted in position. The whole building was designed to make the use of such standardized units possible. The building consisted of a vast rectangle, 1,851 feet long, fashioned step-wise with a flat central roof 64 feet high. In the centre were transepts with a barrel-vaulted roof 104 feet high. The nave and transepts were the same width—72 feet, and the structure was based mainly on a framework involving 24-feet centres. The 3,300 standard columns were spaced at these intervals, and the 2,300 girders were, with a few exceptions, of this length. The design thus partially evolved from a conception of the use of a few standardized units repeated in large numbers. It was the first big attempt at mass-production methods for building, and it is doubtful if it has been surpassed for speed and efficiency. It is in this way that the Crystal Palace represented a great development in the history of building construction, and it is mainly in this way that it showed great possibilities for future building (Plate XX).

As a progressive work of engineering it is less important. The span of 72 feet of the vaulted roof is not remarkable. Many roofs of greater span were designed earlier—the wooden vaulting of the Salone at Padua was 95 feet, while Horeau's span for the Market Hall in Paris, designed, but not built, in 1849, was 260 feet—and many were erected about this time. The roof span of the Paris Exhibition of 1855, for example, was 157 feet. Yet there can be little doubt that the Crystal Palace, as rebuilt at Sydenham in 1853, with the nave changed to barrel-vaulting, was not only a monument of the early method of standardization in building, but was a work of considerable beauty. It was a familiar landmark in South London until its destruction by fire in 1936, with its long nave and transepts very happily proportioned, and its circular roofs shining grey-blue on a cloudy day, sparkling and glistening when the sun shone, and opalescent in moonlight. And though with glass the definition of interior volume is not so marked as with a stone or brick building, the transparent surface seeming to carry the eyes sometimes to distances beyond, this slightly intangible element contributed rather than otherwise in conveying an exhilarating sense of space. Yes, that word exhilarating is what expresses so well the pleasure that one so often derived from the sense of vastness whilst in the Crystal Palace. I remember as a child feeling a little awed by the immense transparent vault above, by the long, almost endless, perspective of the nave, and by the big shadowy recesses under the galleries, but I grew to delight in them; and whether I was listening to singers or to the organ, or dancing in the centre transept, or looking at that unrivalled collection of casts of the great sculptures of the world, the sense of exhilarating vastness was always present and always seemed to preserve an atmosphere that carried suggestions of infinity.

The Hyde Park building was also important as housing the first great international exhibition in the world. Exhibitions had been held throughout the first half of the nineteenth century, particularly in France, but none was international in scope. These exhibitions were the modern successors of medieval fairs. The first was held in Paris in 1798 after the breakdown of the guild system. This exhibition was strictly national in character, but it gave a lead to subsequent exhibitions in one important particular: a large central portion was devoted to goods of everyday use. All the subsequent exhibitions in Paris up to that of 1849 were similarly limited by national thinking. But the London Exhibition of 1851 effected the change. It was probably partly due to the British policy of free trade, and the British position of being the workshop of the world that prompted Prince Albert and his associates to make it international. It was the first of a long line of great international exhibitions. Yet these were chiefly held, not in London, but in Paris. The Paris Exhibitions of 1855, 1865, 1878, 1889, and 1900 were, in scope and magnificence, superior to any held elsewhere in Europe. The French, it seems, have a particular faculty for organizing exhibitions, and they appear to have maintained their pre-eminence in later years up to the exhibition of 1937; although the excellence of some exhibitions in other European countries seemed at times to challenge this pre-eminence. But France has, I think, retained its position as the country *par excellence* of exhibitions.

Buildings for these exhibitions provided great opportunities for engineers in experimenting with new constructional methods. They provided vast experimental and research laboratories where new methods could be tried out, and, if successful, be employed in more permanent structures, although those responsible for buildings of the latter kind were generally slow to follow the suggestions provided by the exhibitions, with the exception of railway companies, who were thinking less of permanence than of profitable progress. Also the desire, which these exhibitions prompted, to enclose large areas to provide free and easy movement for a large number of people, presented a sort of challenge to engineers to build structures with great spans.

The Paris Exhibition of 1855 ('exposition universelle des produits de l'industrie') had a principal building called the Palais de l'Industrie in the Champs-Elysées, and a long Galerie des Machines by the Seine. The former was built with a semicircular iron and glass roof with side galleries. As already mentioned, the span was 157 feet, the greatest span which had been achieved in a building at that time. There were no tie-bars and the thrust of the semicircular iron arches was taken by blocks of lead which served as buttresses, while—unlike the Crystal Palace—the side walls were of solid stone. The Galerie des Machines was also constructed with an iron and glass semicircular roof, but having a considerably smaller span, was much lighter in construction. It was 3,940 feet in length and the uninterrupted perspective must have created a dramatic effect.

The Paris Exhibition of 1867 was even more ambitious in design and scope. It was situated on the Champ-de-Mars, the site of some of the earlier exhibitions. It took the form of an ellipse with the galleries forming seven covered concentric ways round a central open palm court encircled by an arcade. The outer gallery was the Galerie des Machines, and was double the size of the others. J. B. Krantz was the chief engineer and he was assisted by Gustave Eiffel. This vast exhibition building is more interesting in design than in construction, and the only reason it was not adopted for later exhibitions was because of the expense of a construction involving a vast number of curved girders which could not be used again as could straight girders. The Galerie des Machines had a segmental iron and glass roof without tie-bars, and a span of about 115 feet. This exhibition of 1867 was also interesting to the architectural student because among its exhibits were many which were forecasts of future developments in building construction.

The Paris international exhibition of 1878 returns to the rectangular layout and consists of long galleries, the outer and largest being two Galeries des Machines held together at the ends by two vestibule pavilions, designed by Gustave Eiffel. One formed the main entrance. This was built mainly of iron and glass with glass panels in the iron frames, and three decorative iron and glass domes, the designs for which Eiffel was not responsible. In this building was used, I believe for the first time, the projecting glass canopy which provided a covered way along the façade of the building. The Galerie des Machines, designed by Henri de Dion, represented an advance on its predecessors. It had a span of about 114 feet, roughly the same as the Galerie des Machines in the 1867 Exhibition. The roof had a pitch of 20 degrees and was constructed of framed girders built up of separate parts that turn from the slope to the vertical and rest on columns. There were no tie-rods, and the thrust was carried from the roof to these side columns. The next stage was to continue the framed girder to the ground without the column, as we find in the Galerie des Machines of the Exhibition of 1889. A stage in development towards this method had been made in 1868 by the English engineer P. W. Barlow in St. Pancras Station.

CHAPTER IX

Iron Construction—Railway Stations, Houses, Factories, and Departmental Stores, 1850–96

THE development of iron construction owed much to the railway companies, as iron was employed in the construction of their vital equipment, and they saw its possibilities as a material for the construction of stations and bridges. It is in the great terminal stations, built since 1850, that we find some of the most interesting and impressive structures of iron and glass, in which the great exhibition buildings clearly had some influence. King's Cross Station, designed by Lewis Cubitt, was built in 1852 (Plate XXI C). (It was described in Chapter IV.) The two semicircular roofs are built of iron and glass, the girders springing from stone brackets fixed to the walls on the outer sides and fixed to the piers of the central arcade between vaults on the inner side. From the standpoint of proportion and of beauty of general effect King's Cross is unrivalled among stations, although many later roofs are perhaps more striking engineering achievements.

Euston was built a little earlier (1848) than King's Cross, but the roof consists of a series of iron and glass sheds supported by iron columns, and has little claim to distinction. Paddington, another impressive example (Plate XXI A), was built in 1854 by the younger Brunel. Here are three elliptical iron and glass roofs resting on columns, and they are crossed by two transepts, the crossings being impressive in appearance. The most noteworthy early example on the Continent was the Gare du Nord, built in 1862, the work of the engineers Couche and Boucher; but the station roof which is perhaps the most magnificent early engineering accomplishment is St. Pancras, built, as already mentioned, by P. W. Barlow in 1868 (Plate XXI B). The shape, like a late Gothic arch, may have been partially determined by the Gothic style of the hotel and offices, but it is a shape particularly suited to a wide span, which in this case is 240 feet, the greatest which had so far been achieved, for Horeau's 260 feet span for the Market Hall in Paris remained but a project. St. Pancras Station is carried on a vast, wrought-iron platform supported by 688 iron columns, the space beneath the station being used for shops and warehouses. The framed roof-girders spring from wall brackets and are fixed to the wall, the thrust being taken partly by these corbels and partly by buttresses. Other fine station roofs were built soon after those mentioned.[1] Two good German examples are the Anhalter Bahnhof in Berlin, built in 1878, and the Frankfurt Station, built in 1888 by C. W. Schewdler. The latter consists of two iron and glass vaults, of a construction not dissimilar to St. Pancras. The arch girders swing down to the ground without intermediate columns. This was to find its finest expression a year later in the Galerie des Machines of the Paris Exhibition. Later German stations noteworthy for their roofs are those at Hamburg (1908) and Leipzig (1916).

Iron columns, and iron framework between walls, were becoming common features of construction by the 1860's, especially in factories, warehouses, exhibition buildings, and railway stations. The next step, in which the iron frame is the basis of the whole structure, the exterior walls being no longer structural but merely screens between the frames, was first introduced in the model of a house exhibited at the Paris Exhibition of 1867 (Plate XXII). This house was the model dwelling of the Co-operative Society of Paris, and was designed by the architect M. S. Ferrand. The construction is described by Edwin Chadwick in an article in the *Illustrated London News* of 6 July 1867. Chadwick says that the walls are of hollow brick which, he states, are double. 'The thickness of the double wall', he continues, 'is 5 inches, which, of course, would be insufficient for bearing purposes. But the wall is held together, and the bearing power is obtained, on what I have termed the Crystal Palace principle, by iron columns, beams, and cross-tees.' The architect claims 'for this construction the advantage of walls which are thin, and which, therefore, save space, and yet are warmer, resist changes of temperature better, and are better non-conductors of sound than the common brick or stone bearing-walls, and that at a lower cost'. If this method of construction for walls of houses had appeared at the Paris Exhibition, not of 1867, but of 1937, it would still have appeared progressive and in advance of contemporary methods. 'Of the superior quality of the wall itself,' says Chadwick a little later in the article, 'of its advantage as a non-conductor of heat and of sound, of its economy of space, and of the general advantage of this iron-tied construction, there can be no doubt.' It certainly appears to be the first example in Europe where the iron frame forms part of the brick exterior walls, although it is nineteen years after the iron-framed constructions of James Bogardus in America.

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[1] Other London station roofs built of iron and glass between 1865 and 1890 worthy of note are Cannon Street, Victoria (S.E. & C. Branch) and Liverpool Street. They are more beautiful than the roofs of later stations like Waterloo and the later section of Victoria, both of which consist of a series of shed-like constructions without distinction of any kind.

The chocolate factory at Noisiel-sur-Marne, built by Jules Saulnier in 1871–2, was the first building of any size constructed on the iron-frame principle throughout. As in the model house the iron framework, consisting of uprights and diagonals, is seen clearly in the brick walls, brick being no longer constructional but merely a filling material. The factory is supported on piers resting in the bed of the Marne as it depends on water power supplied by the river.

A distinction must be made between the iron frame building, like the Crystal Palace, and that in which parts of the iron frame are embedded in brick or stone walls. The development of the former takes place principally in exhibition buildings and railway stations. The development of the latter occurs in buildings of a more traditional or permanent character. The early examples represent a transition from stone or brick construction to iron construction, a feature of this transition being the iron frame appearing in the walls as in the model house and in the Menier chocolate factory. But later in the application of the iron frame to building, regulations required that the iron frame, at least in the exterior walls, should be encased in stone, brick, or concrete as a precaution against fire.

The early use of the iron frame in buildings appears chiefly in factories and departmental stores. The departmental store was a new type of building that began to appear in the latter part of the nineteenth century. Its evolution from the shop selling only one class of goods has not been traced, but it is probable that it was gradual as we hear of various stores from time to time throughout the century. The departmental store is the outcome of circumstances produced by the great growth of population during the nineteenth century, the consequent growth of cities, industrialization, and mass production, and the growing complexities of distribution which had the effect of increasing the number of agents between producer and consumer. When a city becomes large, when the standard of living so improves that there is a demand for a greater number and variety of goods, when mass production, by reducing prices and increasing quantities, puts such goods within the reach of an ever-increasing number, then shopping is greatly assisted if an immense variety of goods can be displayed under one roof. The departmental store is therefore an evolution from the market hall, while its purpose is somewhat similar to the exhibition building. There must be extensive space for the display of goods, there must be the maximum of light, and there must be room for the free and easy movement of a large number of people. It is, therefore, not surprising that dramatic progress has been made with the departmental store, and it is here that we get some of the earliest and most expressive of steel-framed buildings.

The earliest departmental store of any size in Europe is the Magasin au Bon Marché in Paris, built in 1876, in which the architect L. A. Boileau collaborated with the engineer Gustave Eiffel. It seems to have been one of the more fortunate collaborations. The store is not unlike an exhibition pavilion. Of iron frame construction it has iron and glass pitched roofs, while the interior consists of numerous galleries supported by iron columns, the fronts of the galleries being of ornamental ironwork. The bulk of the constructive work is cast iron, but there is a certain amount of steel. The exterior walls are faced with stone and brick to conform to fire regulations. The Magasin au Printemps, built by Paul Sedille in 1889 was constructed of the steel frame, but the ornate Renaissance exterior gives no suggestion of this. Alfred Messel's Wertheim store in Berlin, built in 1896, though not representing any technical advance on several steel-framed store buildings built in the eighties and nineties, is yet an early example in Europe where the steel frame construction has a marked influence on the appearance of the building.

CHAPTER X

Steel Construction—Bridges and Exhibition Buildings, 1856–1918

THE possibilities of structural development were greatly increased by the conversion of iron to steel on a larger scale and more economically after the invention of the Bessemer process in 1856, for it put at the service of engineers and builders a structural material superior to either cast or wrought iron. Steel had been used before 1856, but it had never been possible to produce it economically in large quantities with any degree of consistency. It had been available only in comparatively small pieces and was not adequate for structural steelwork on a large scale. The disadvantage of cast iron is that, though having great compressive strength, it is unreliable when subjected to sudden shocks and intense heat, while the disadvantage of wrought iron is that it is too soft for many kinds of structural work. The difference between cast iron and wrought iron is due mainly to the carbon content. Cast iron has between 2·5 and 5 per cent. of carbon, whereas wrought iron generally has less than 0·15 per cent., and is almost pure iron. The introduction of a little carbon produces steel, between 0·8 and 1·3 per cent. for high carbon steel and between 0·25 and 0·5 per cent. for mild steel, which is generally the kind used for structural work for building. There are other elements in small quantities in iron-ore like silica, sulphur, phosphorus, and manganese, which are beneficial or otherwise to steel according to the quantity present and the kind of steel required. Small quantities of sulphur, for example, are considered to be beneficial to mild steel; while manganese gives a combination of hardness and malleability and is often introduced in the requisite quantities when these qualities are required. Numerous other elements are introduced to give or strengthen certain desired qualities, cobalt, for example, is introduced to get a higher magnetic quality, and the introduction of nickel, chromium, tungsten, molybdenum, vanadium, silicon, all give certain qualities. Although for the period up to 1919 ordinary mild steel had been mainly used for building, experiments had been made with high-tensile steel and it had been used to some extent in bridge-building, the use of nickel steel for a bridge at Cologne, built in 1914, being an example. Later alloy steels for constructional work are silicon steel and copper–manganese steel.

Standard sections for steel structional members were being employed in most European countries early in the present century. These members are made in rolling mills. The United States has been the most progressive in making calculations for the standard sections, and of evolving the standards. They are slightly modified from time to time. The commonest sections have evolved from the cast-iron and wrought-iron beams used from the earlier half of the nineteenth century, to which I have already referred. The sections most generally used are the flat, or plate, the I or double tee, the commonest of all and generally referred to as the rolled-steel joist with the well-known abbreviation of R.S.J., the channel, angle, and the tee. British standard R.S.J.'s are made from 3 inches deep by 1½ inches wide to 24 inches deep and 7½ inches wide. But when girders of more than 18 inches are required they are often used in a built-up form, with plate girders, angles, and other forms riveted together. A later development is the use of welded steel, but I will refer to that when dealing with structional developments in the 1919–39 period.

It is in bridges that there have been some of the most remarkable developments in iron and steel construction. These developments in bridge design have had considerable influence on construction in building and are, I think, destined to have an increasing influence. Also, they are important architecturally because some of these bridges are beautiful works of engineering, and must be regarded as architecture of merit.

For the spanning of great distances the suspension, cantilever, or arch bridge has generally been employed. The principle of the cantilever and its application to bridge design had been experimented with for many years. An iron cantilever bridge was designed by Young in 1856, a model of which is illustrated (Plate XXIII B). The first iron cantilever bridge actually to be built was that across the Rhine at Hassfort, in 1866.

The Forth Bridge (Plate XXIII C) is the use of the method on a great scale. Designed by Sir Benjamin Baker and Sir John Fowler it was being built from 1881 to 1889. Its total length is 5,330 feet, with two central spans of 1,710 feet. Many of the structural members are of tubular steel, some of the pier tubes being 12 feet in diameter. This gives the bridge a heavier appearance than if it were constructed of solid girders, but it was calculated that with solid members the same lightness and strength would not have been achieved. The cantilevers of the main spans project 680 feet, being gradually built outward, the gap of 350 feet in the centre being bridged by lattice girders resting on the ends of the cantilevers. The Forth Bridge is not only a remarkable engineering achievement, but a work of considerable beauty, and was one of the first large structures in Europe to demonstrate that steel construction, as well as stone and brick construction, has its own unique beauty. The tubular members may be bulky, yet the bridge is on such a big scale that when seen at a distance and as a whole it appears to a generation accustomed to steel structures as a work of good proportion. The arch girders springing from the piers make a beautiful rhythm suggesting a movement of striding majestically across the Forth. Its spans have since been exceeded by only one cantilever bridge, that at Quebec, where the single span is 1,800 feet.

Steel cantilever bridges during the last years of the nineteenth and early years of the twentieth century were built in many parts of Europe. One of the most striking is the Viaur Viaduct between Rodez and Carmaux in the South of France (Plate XXIII A). It was designed by Professor P. Bodin, of the Société de Constructions des Batignolles, and built from 1898 to 1902. It spans a deep ravine, and the track is 380 feet above the bed of the river. The total length is 1,345 feet, with a central span of 722 feet, the rise of the arch being 176 feet. It is constructed of mild steel. It will be seen from the illustration that the thrust of the central arch is counteracted by the thrust of the shoreward arches. The structure is conspicuous for lightness and elegance, and achieves that beauty which is in no small measure the outcome of an expressive use of its material.

Another method of crossing a deep ravine is by means of a trestle bridge, which is really another term for the span bridge with vertical pier supports. The substitution of iron or steel gives the piers a trestle form and character. It is a particularly good method where it is impossible to obtain an absolutely straight bridge. One example is the Fades Viaduct, where the iron bridge is carried on granite piers, and is 434 feet 8 inches above the river. Examples in England are the Belah Viaduct, 1,000 feet long with fifteen iron piers constructed in four months in 1860, the Halesowen Viaduct in Staffordshire, and the Meldon Viaduct near Okehampton (Plate XXV). In the last two the tracts are curved, and are supported on steel trestles. The Meldon Viaduct was built in 1879. The trestles, 90 feet apart, are so constructed as to counteract the thrust due to trains running on the curve.

Suspension bridges were first built chiefly in Great Britain during the first half of the nineteenth century. Two—the Menai and Clifton—have already been mentioned. Some, like the Kenmere, Hungerford, and Lambeth suspension bridges have since been demolished, but others, early examples like those at Whorlton-on-Tees, Conway, the suspension bridge at Hammersmith, the Victoria Bridge at Battersea, and the small bridge in St. James's Park still remain. It is not a type that has been much developed in Britain in later years; the principal developments have occurred in other European countries and in America.

Suspension bridges were built in Spain in the latter half of the century. One noteworthy example is the Vizcaya Bridge at Bilbao (Plate XXIV), built between 1890 and 1893. It is a carriage bridge over the river, and consists of two trestles at either end, between which the carriage rises from the roadway and then moves horizontally over the bridge. It was designed by Alberto Palacio. The span is about 538 feet and the bridge is about 150 feet above road level. It is a light and delicate structure, but it might be doubted if the necessity of the bridge is strongly apparent. To cross from one embankment to another, one goes in a carriage which rises 150 feet, then moves horizontally, and then drops at the other side. It seems that a ferry service could be as quick and more efficient, for the carriage is limited to thirty tons, whereas a small ferry barge could carry at least 200 tons. It is possible that if motor-boats had come on the scene earlier this bridge would never have been built.

A suspension bridge in France worthy of note (Sequin's bridge over the Rhône built in 1824 was mentioned in Chapter VII), built between 1906 and 1908, is the Gisclar Bridge, taking the line from Villefranche to Bourg-Madame. It has a central span of about 840 feet.

Some of the most beautiful and magnificent bridges built during the period of which I am at present writing are of the arch type. This type had been the commonest in brick and stone, and arch bridges of these materials have continued to be built, and some of the spans achieved in stone bridges, considering the nature of the materials, are remarkable. These wide spans in stone bridges were obtained by the use of the elliptical arch. The stone Grosvenor Bridge at Chester, built in 1833, has a span of 200 feet. The greatest span achieved with a stone bridge is that of the elliptical bridge at Plauer, in Germany, built in 1903, which has a span of 295 feet. The lovely elliptical sweep of the arch makes it one of the most beautiful of bridges.

Early iron arch bridges followed, as we have seen, the principles of stone constructions, and bridges like those at Coalbrookdale (1779), Sunderland (1793), Rennie's first iron bridge at Boston, in Lincolnshire (1807), Telford's lovely Craegellochie Bridge (1813), the Galton Bridge at Smethwick (1822), and other early examples were all to some extent translations of stone into iron. One of the factors that limits the span of an arch bridge is that if the river, road, or railway track to be bridged is of limited depth from the proposed crossing it means that a wide span involves too flat an arch to be structurally strong. Often in getting a single span there is a considerable rise in the road approaching the bridge, a common feature of old stone bridges. Increased spans were, however, obtained by carrying the arch as high as necessary and the roadway through the centre of the bridge. This method of construction is a fairly late development, and is responsible for some of the most spectacular engineering feats between the two wars, like the Sydney Harbour Bridge.

There is a similarity in the principle between this arch type and the bowspring type like the Saltash Bridge built by Brunel. Here the arches of tubular iron from which the bridge is suspended are necessary for the spans of 485 feet. The arch of the bowspring can be reversed, and would be in appearance somewhat like a suspension bridge, only it would be taut with a thrust, and not merely hanging. The Saltash Bridge is a combination of the bowspring and suspension type.

Early developments of the iron-steel arch bridge with the road running through have taken place mainly in France, due mainly to the pioneer work of that great engineer Eiffel. Early examples are the Sioule and Neuvial Viaducts (1862), the bridge of Maria-Pisa over the Douro in Portugal with a span of 525 feet (1875), and Eiffel's Pont du Garabit with a span of 574 feet (1879–82).[1]

One of the most impressive bridges to be constructed in this manner, and still the most beautiful of them all, is the bridge at La Roche Bernard, over the River Vilaine on the road from Nantes to Brest (Plate XXV). It was constructed in 1910 by the engineers Daydé. It has a span of about 660 feet. The thrust of the arch is taken by massive blocks of masonry built on the shores, from which also rise stone piers to take the ends of the bridge, which are supported on stone arches. The roadway through the arch is held in the centre by ties suspended from the top of the arch, and by girders attached to the arch near the springings. The sweep of the arch is magnificent, and the whole steel framework is of remarkable lightness. One feels that in its lightness and elegance it is typical of French genius, and in these qualities it is unexcelled. It is one of the great aesthetic achievements of engineering.

During the First World War three steel arch bridges were built over the Rhine by the Reichsbahn, at Rudesheim, Remagen, and Engers. The first was built in 1915 and the other two in 1917–18. They were all built on the tied-cantilever arch principle. The centre span of the bridge at Remagen[2]

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[1] Illustrations of the two last mentioned bridges are given in *Esthétique et Construction des Ouvrages d'Art*, by Jean Démaret (Paris, 1948), Plates LVII and LVIII.

[2] It was this bridge that the Germans failed to destroy in their retreat across the Rhine

(Plate XXV) was 512 feet and that at Engers 617 feet. Although efficient structures, with general shapes not unpleasing, they have none of the lightness and elegance of a bridge like that at La Roche Bernard, which must for long be regarded as one of the great works of art that steel construction has given us.

Some of the greatest structural engineering achievements of the nineteenth century in Europe appeared at the Paris Exhibition of 1889. A dominating feature was Eiffel's tower, behind which was the gallery for general exhibits connecting the building housing the *beaux-arts* and *arts liberaux*, and at the farther end was the Galerie des Machines. The Eiffel Tower, which is all that remains of the exhibition buildings, was a product of mathematical calculation in which numerous pre-fabricated steel parts were fitted together. The tower rises from parabolic arches on the four sides; it has the appearance of being supported on four legs spread out and standing firmly on the ground. Like the Crystal Palace it was derided for many years as ugly, William Morris saying that when he went to Paris he used to stay as near as possible to its base so that he could not see it. But now a more enlightened generation thinks of it not only as a remarkable achievement of engineering, but an object of beauty with its long lines swinging from its bases to the slender tapering steel network of the tower, reaching to a height of 1,025 feet (Plate XXVI B).

The Galerie des Machines of the Exhibition of 1889 was a development of the construction of that of 1878, but it represents a tremendous advance. The architect was Dubert, but the chief credit of this remarkable structure must be given to its engineer Cottancin. The flat, pointed vault of steel lattice girders and glass has a span of approximately 378 feet,[1] a great increase on the previously biggest span of 240 feet of St. Pancras Station. A large moving crane with a gallery for spectators was erected inside the building, which enabled visitors to obtain a comprehensive view of the exhibits. The construction is similar in method to that employed in the iron and glass vaults of Frankfurt Station, completed in 1888, but it is on a much bigger scale. At the point of spring each lattice girder is triangular in shape and forms a broad point connexion with its base. At the stage where the girder bends from the vertical it is buttressed by the roof of the

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in April 1945, thus enabling the Americans to get across more rapidly and form a bridgehead. The bridge was destroyed later.

[1] The span is generally given as 115 metres. Siegfried Giedion, in *Space, Time and Architecture*, gives the span as 150 metres (p. 203), that is, about 493 feet. This, I conclude, must be an error.

side aisle. The similarity of the principle of construction of this steel-ribbed roof to the stone-ribbed Gothic vaulting is clear, the downward and outward thrusts being counteracted in a similar way. But the very tensile rigidity of steel in this form of construction makes the counteracting of the outward thrust far less of a problem than in Gothic stone vaulting.

It is a matter of regret that this masterpiece of steel construction was destroyed in 1910. More than any structure so far built it demonstrates the tremendous possibilities of steel construction. As a great engineering achievement, magnificent in conception and daring in design, it remains, even now, after over half a century, unsurpassed.

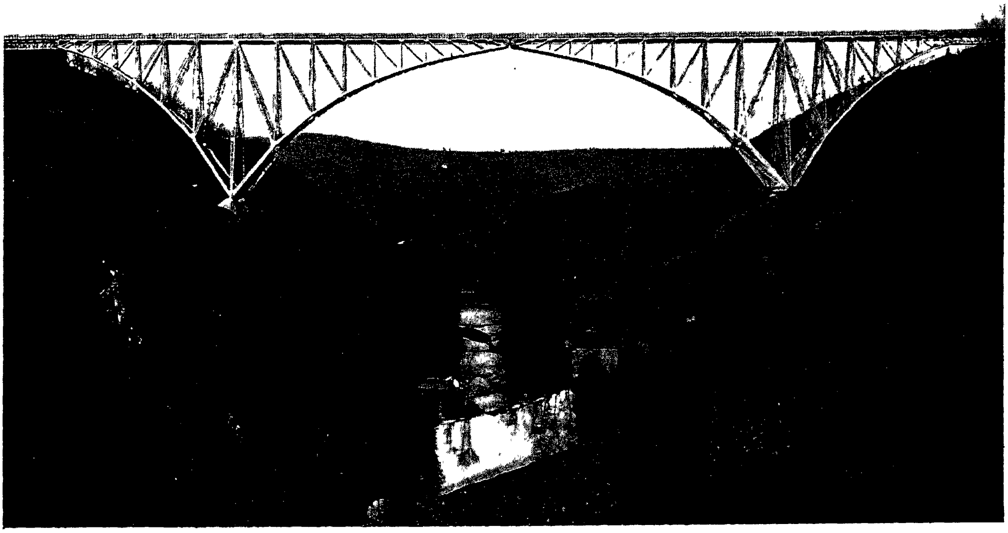
CHAPTER XI

Reinforced Concrete

IN the closing years of the nineteenth century and the early years of the twentieth, rapid progress was made, not only with steel frame construction, but with the new reinforced concrete construction. In the matter of steel frame construction one may say that for a hundred years before about 1895 there was a period of pioneer work, and in the case of reinforced concrete, which was a little later in developing, about seventy-five years before 1905 was the pioneer period. From about 1895 to 1925 has been a period of constructional transition in the case of large buildings (for small houses must be excepted) at first mainly from stone and brick construction to steel frame construction, and then partially, but increasingly, to reinforced concrete construction, partly on the frame principle and partly by other methods. After the First World War the new methods and materials were almost established, and the large building constructed in the old way where stone or brick was the constructional material was the exception rather than the rule. Stone and brick became filling, facing, and decorative materials. Although the construction had changed, the transition from the appearance of the traditional stone or brick building to an appearance expressive of the changed structure was more gradual. The number of buildings constructed with the steel frame immediately before and after the First World War was greater than those constructed of reinforced concrete, but the latter have gradually increased in proportion.

Concrete was used in ancient Rome. The binding material on which it depended appears to have been lime mortar, which had previously been used for masonry joints by the Greeks. The dome of the Pantheon, 142 feet in diameter, is generally regarded as being of solid concrete, but it is difficult to be certain that it is of concrete throughout. One theory, derived from an examination by Chedanne, is that it is partly constructed of brick, consisting of horizontal courses at the lower part and near the opening at the summit, with brick arches in the middle, the brickwork being embedded in thick mortar. The roofs of the Baths of Caracalla were constructed of lime concrete reinforced with bronze rods. It is possible that the dome of the Pantheon is similarly reinforced in parts, but it is difficult to discover in a structure still completely intact. We are only aware of the bronze rods in the former because they were discovered in the broken remains.

The ability to make concrete seems to have been lost between the Roman



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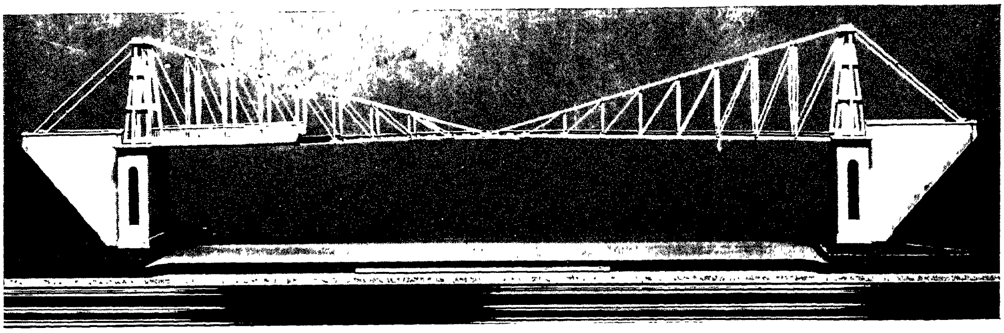

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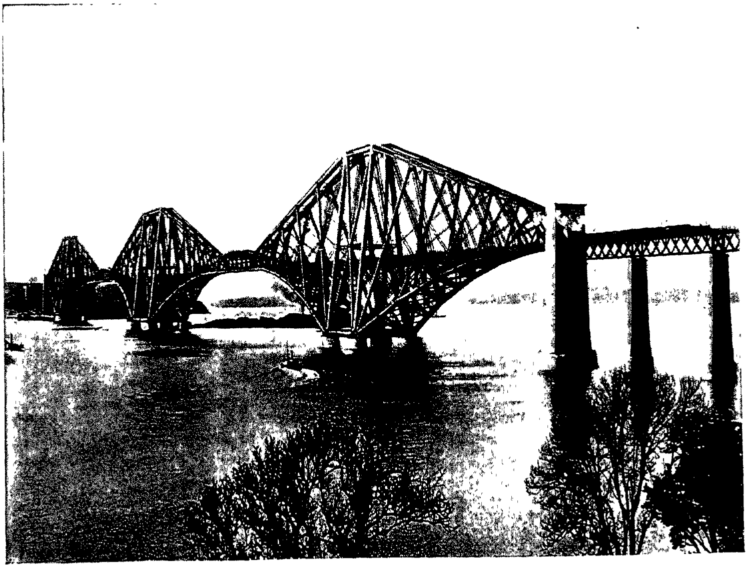


C

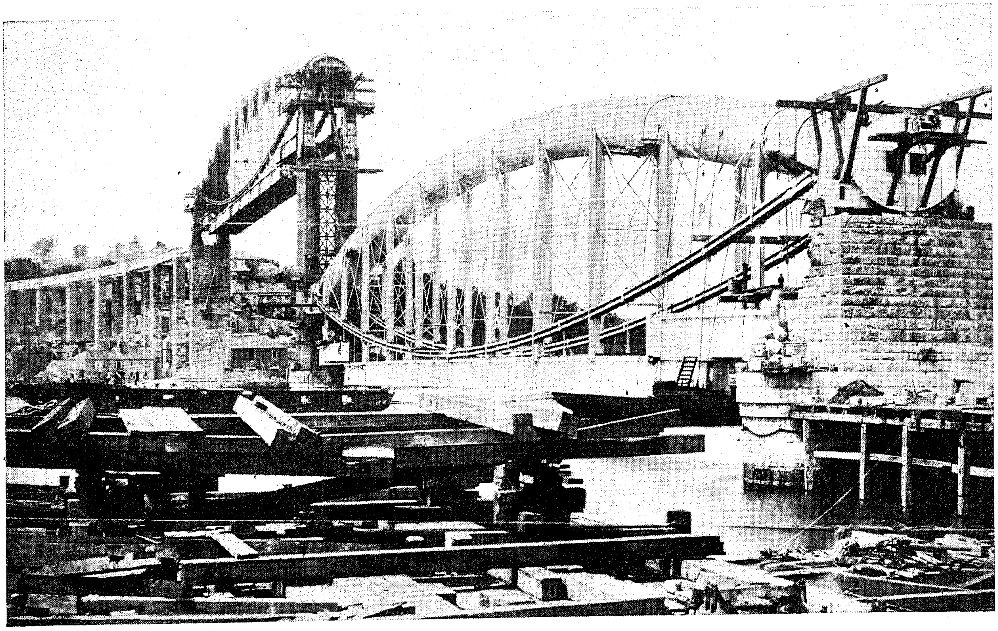
A. VIAUR VIADUCT, FRANCE, DESIGNED BY PROFESSOR P. BODIN AND COMPLETED IN 1902

B. MODEL OF YOUNG'S IRON CANTILEVER BRIDGE, DESIGNED IN 1856

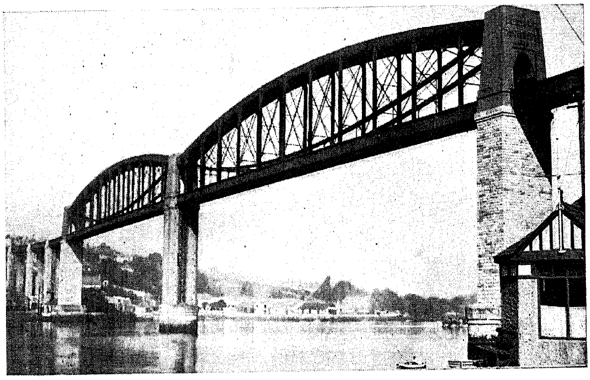
C. THE FORTH BRIDGE, DESIGNED BY SIR BENJAMIN BAKER AND SIR JOHN FOWLER AND COMPLETED IN 1889

CANTILEVER BRIDGES

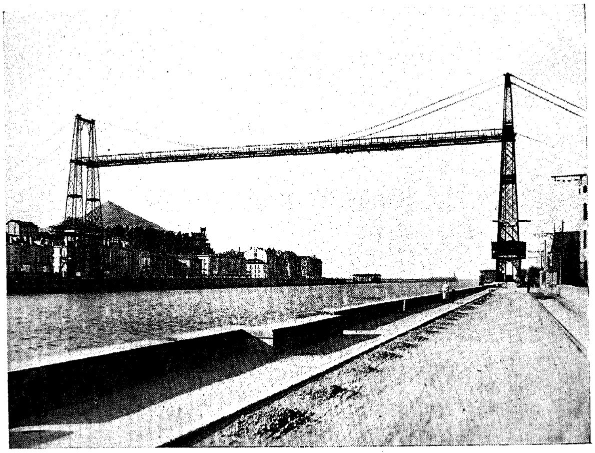
PLATE XXIII



ROYAL ALBERT BRIDGE, SALTASH (COMPLETED 1859) IN COURSE OF CONSTRUCTION

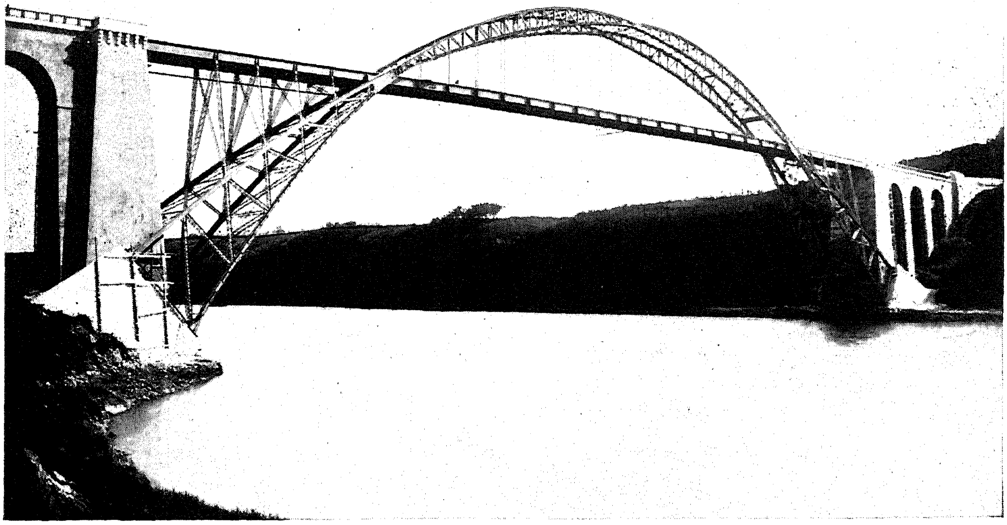


THE BRIDGE AS COMPLETED
Engineer: I. K. BRUNEL

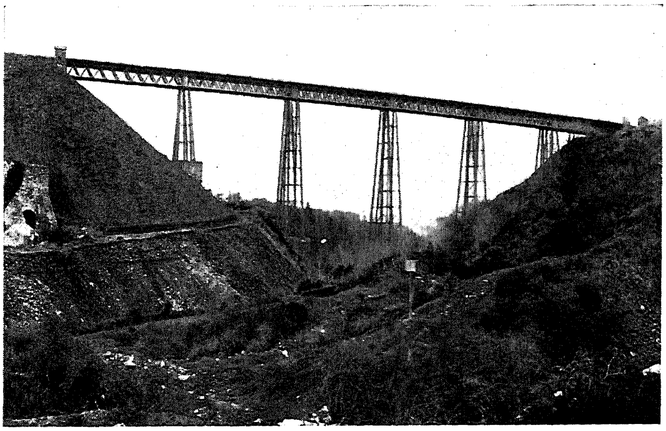


THE VIZCAYA BRIDGE, BILBAO, DESIGNED BY ALBERTO PALACIO, COMPLETED *c*. 1893

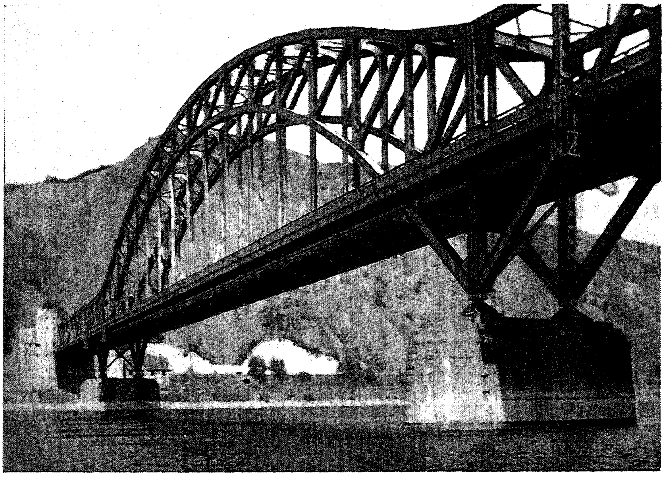
PLATE XXIV



ARCH BRIDGE OVER THE RIVER VILAINE AT LA ROCHE BERNARD, BUILT IN 1910 BY THE ENGINEERS, DAYDÉ

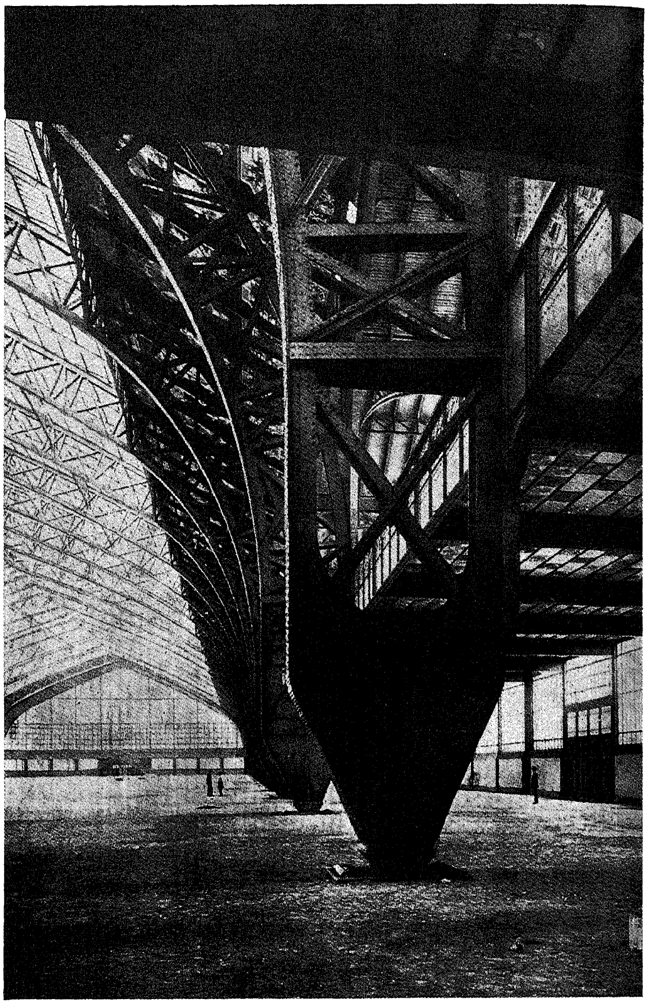


TRESTLE BRIDGE OVER THE MELDON VIADUCT, NEAR OKEHAMPTON, COMPLETED 1879



GERMAN STEEL ARCH BRIDGE OVER THE RHINE, NEAR REMAGEN, BUILT IN 1917

PLATE XXV



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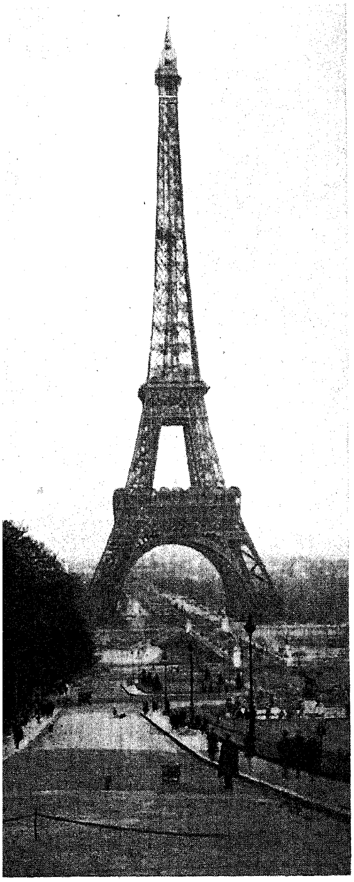

Paris Exhibition of 1889

A. THE GALERIE DES MACHINES. *Architect*: A. DUBERT. *Engineer*: COTTANCIN

B. THE STEEL AMUSEMENT TOWER, DESIGNED FOR THE EXHIBITION BY GUSTAVE EIFFEL

PLATE XXVI

period and the eighteenth century, due to the lost secret of the binding material. It was not until John Smeaton produced a cement as the result of his experiments in connexion with the building of the Eddystone Lighthouse, which was completed in 1774, that concrete was again used. Smeaton had observed earlier that quicklime mixed with clay hardens under water, so in constructing the foundations for the lighthouse he used concrete composed of quicklime, clay, sand, and crushed iron-slag. Improvements in concrete depended mainly on improvements in binding material. About 1800 Vicat, a French chemist, produced a cement by burning together finely pulverized chalk and clay; and in 1824 Joseph Aspdin produced what is now called Portland cement.[1] Aspdin mixed finely pulverized chalk and clay in specified proportions, burned them at a high temperature, and ground the resulting clinker. By this means an hydraulic cement was produced superior to any previously known. Improvements of quality and the easily accessible materials on the banks of the Thames and its tributaries made the production of Portland cement a rapidly growing industry, with a considerable export trade. Later, similar cements were manufactured in various parts of Europe.

Solid concrete was used for various purposes from the latter part of the eighteenth century. It was used for foundations, for gate piers (those of the garden gateway at Horace Walpole's villa at Strawberry Hill being an early example), for floors, beams, and as a general filling material. We have seen that it was used to fill in between the floor and iron-plated ceiling in a factory built by Sir William Fairbairn in 1845. The iron beams supported on cast-iron columns are embedded in the concrete but, as in many similar floors, the concrete here performs no structural function. François Coignet, a French builder, used mass concrete beams in 1861, and it was used for roofing the Restaurants of the Nations on the basement floor in the Paris Exhibition of 1867. This exhibition had many important concrete exhibits. Among them were houses of concrete with flat concrete roofs. Edwin Chadwick remarks of the roof[2] that it provides 'the possibility of making the ceilings and roofs of houses as with one large slab of stone. The principle of construction established by these concretes is that everything is made, as it were, a monolith'. He later speaks of the model dwellings as built on the

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[1] Smeaton had compared his concrete with Portland stone, to indicate its durability, similarity of colour probably partly prompting the comparison. The name may have been suggested to Aspdin by Smeaton's reference to it, or he may himself have been prompted to use the name independently for the same reason.

[2] Model Houses at the Paris International Exhibition, 1867. *Illustrated London News*, 6 July 1867.

Prince Consort's principle of flat roofs, which implies that the Prince Consort was an early pioneer of this type of roof. Several cottages appear to have been built of concrete at about this time. There is a village near Barnsley, in Yorkshire, where there are some cottages about eighty years old built of concrete, and the village takes its name from the circumstance, being called 'Concrete'. Some concrete bridges were built during this period in England. P. Morton Shand[1] speaks of one at Sidmouth, 'believed to be the first of its kind built in England', which 'probably belongs to this decade' (the 1860's). A bridge built across the District railway between Gloucester Road and Earls Court in 1867 has, however, been claimed as the first concrete bridge. An arch bridge of solid concrete, consisting of one part of fresh blue lias lime to six parts of gravel screened through ¼-inch meshes, finished with cement, and tooled into voussoirs in imitation of stone, it had a span of 75 feet, with 7 feet 6 inches rise, and was 3 feet 6 inches wide at the crown and 5 feet 6 inches at the haunches. The original width was 12 feet, but it was widened in 1869. The bridge did not last long, because it had ceased to exist in 1873. The bridge at Sidmouth, on the contrary, still remains.

There was a growing consciousness among pioneers of concrete construction that its future depended on a reinforcement which would correct its tensional weakness. In compression concrete is strong, having a compressive strength of between 1,600 and 8,000 lb. a square inch![2] In tension it is weak, being no more than 160 lb. to the square inch. Mild steel, however, has an approximate tensile strength many thousand times as great.

A good deal of the early pioneer work in the reinforcement of concrete took place in England. Some early devices take the form of iron meshing in concrete roofs and flooring. Thus J. C. Loudon, in an *Encyclopedia of Cottage, Farm and Village Architecture*, published in 1830, suggests that a lattice-work of iron rods could be embedded in the concrete. In 1854 W. B. Wilkinson patented a device for constructing floors of concrete reinforced with flat iron rods placed vertically. What is interesting in this reinforcement is that the rods are low in the centre and rise at the points of support, thus showing an appreciation of the essential value of the iron reinforcing. This is the first instance in which the essential structural principle of reinforced concrete is demonstrated. That principle is that concrete, being weak in tension, must be reinforced at those parts where tensional strength is required commensurate with its compressive strength. To take the simplest case—when a beam supported at both ends is subjected to a thrust from above, the centre part above the neutral axis is in compression and the part below in tension; it is thus in the lower part that steel reinforcement is required. At the points of support the thrust is from below and the beam reinforcement is at the top.

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[1] P. Morton Shand, 'Steel and Concrete: A Historical Survey', the *Architectural Review*, vol. lxxii, pp. 169–79, Nov. 1932. This is the best history of reinforced concrete that has so far appeared in English, and I am indebted to it for some of the information in this chapter.

[2] This considerable variation depends on many factors: on the proportions of water, cement, sand, and ballast; on the kind of cement and on the aggregate. With high-alumina cement and a hard-stone aggregate scientifically mixed it is possible to achieve a compressive strength of 8,000 lb. to a square inch after twenty-eight days. It is expected that in the future greater compressive strengths will be achieved.

A year later, in 1855, François Coignet patented a system of reinforced concrete floors not dissimilar from that of Wilkinson. Coignet was responsible for a large amount of constructional works, including a lighthouse at Port Said, retaining walls in Paris, and aqueducts for the Paris water-supply, concrete being used in much of the work, and he may have employed his system of reinforcing in some of these constructions.

During the 1860's the introduction of methods for reinforcing concrete were exceedingly numerous. A London builder named Matthew Allen employed reinforced concrete floors and stairs in the construction of Columbia Market at Shoreditch in 1862. Three years later Frederick Ransome invented concrete beams reinforced with hoop iron, and in 1867 H. Y. B. Scott applied this device to floors in combination with tie-rods embedded in concrete. In this year Edwin Chadwick speaks of a device of B. Nicoll which appears to be a meshing reinforcement of a kind of concrete.

> Over a framework of strong cross wires, of about an eighth of an inch thick, there is woven by a powerful machine a mass of straw or fibrous matter which is saturated with a solution that renders it fireproof. It is then subjected to very powerful pressure. A coating of light Scott's cement mixed with Parian cement is then put upon it for inside facing, and of Portland cement for the outside facing. The surfaces are impermeable to moisture, smooth and washable with water, so as to save the expense of repeated lime-washings. It is formed into slabs in iron frames, which are put together closely and securely fastened with bolts. The slabs are from 1½ inches to 4 inches thick.[1]

At the Paris Exhibition of 1867 Joseph Monier exhibited his concrete flower pots and tubs which were reinforced with iron meshing or rods. Monier continued making experiments and he took out many patents for the construction of floors, slabs, steps, and other building parts. The German engineer G. A. Wayss, seeing some of these at the Antwerp Exhibition of

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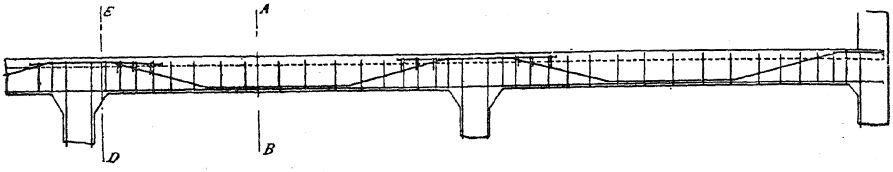
[1] Edwin Chadwick, 'Model Houses at the Paris Exhibition 1867', *Illustrated London News*, 6 July 1867.



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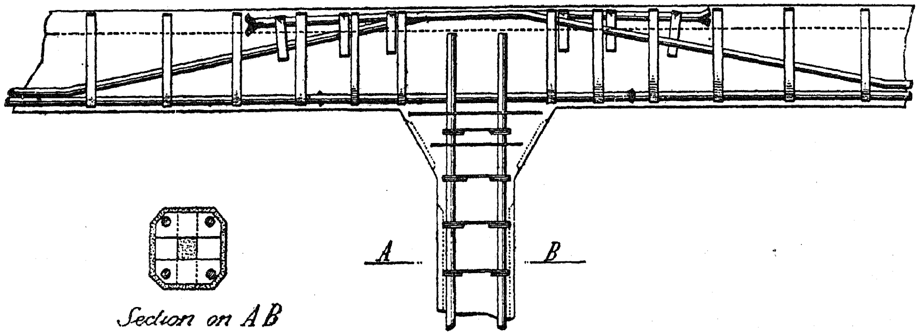

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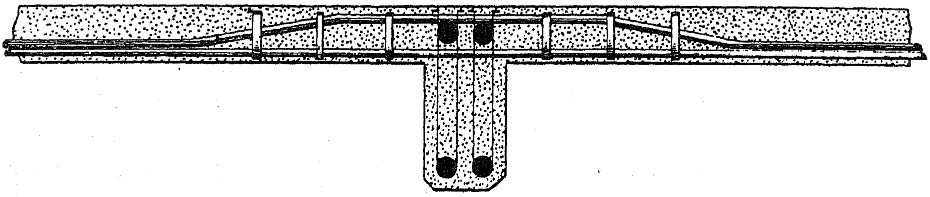

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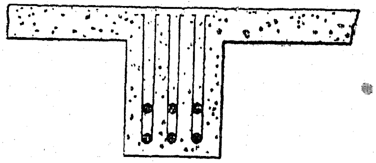
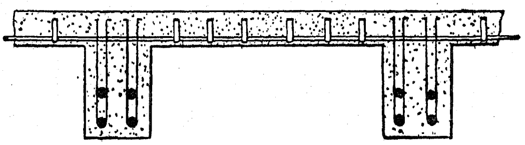
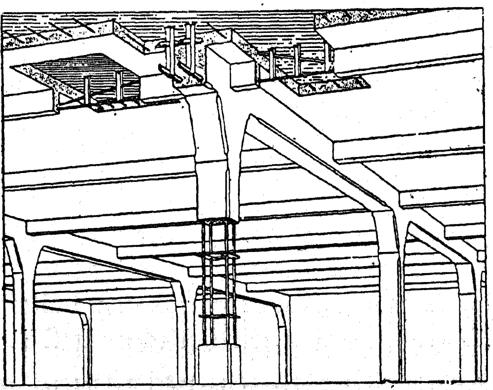




E

HENNEBIQUES SYSTEM OF REINFORCED CONCRETE

A. SECTION THROUGH BEAM.
B. JUNCTION OF BEAM AND COLUMN.
C. CROSS-SECTION THROUGH BEAM AND FLOOR.
D. SECTION THROUGH MAIN BEAM.
E. SECTION THROUGH SECONDARY BEAMS AND FLOOR.
F. MAIN BEAMS, SECONDARY BEAMS AND FLOOR, FORMING A MONOLITHIC MASS.
G. METHOD OF REINFORCING COLUMNS.



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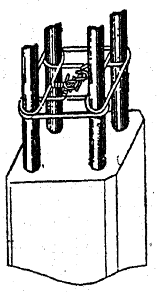

G

PLATE XXVII

1879, acquired the series and started the firm of Wayss and Freytag, of Frankfurt-on-Main. Floors reinforced on the Monier system between walls of solid concrete appear in an office building in Lincoln's Inn Fields, built by William Simmons in 1885.

From 1870 onwards inventions for reinforcing concrete were numerous, some being definite contributions to its development, among them being Philip Brannon's invention of 1871, the several inventions of Thaddens Hyatt, an American working in England, and Meyenberg's in 1891. Contemporary with these endeavours much valuable work was done by many scientific investigators who helped to establish the principles of construction on a mathematical basis, from which standards and rules of practice were later gradually formulated. Among these were M. Koenen, Paul Neuman, N. Tedesco, and, most important, Edmond Coignet, who made calculations of stresses and strains to ascertain the exact mathematical structural capacities of these combinations of steel and concrete. Armand-Gabriѐle Considѐre assisted these calculations by some important researches into the varying strengths of different kinds of concrete, because until some regular and dependable consistency was determined it was not completely satisfactory to make mathematical tests of structural capacities of the concrete and the steel reinforcement. In 1892 François Hennebique devised a complete system of reinforced concrete construction which did much to lay the foundations of modern practice. Coignet and Considѐre also developed systems which have influenced modern practice. Each system follows the same essential principles, but varies in detail.

Hennebique's was the most widely adopted system in the early period. It combines and perfects many of the previous pioneer contributions. It is well illustrated by floor construction consisting of beams. In a typical beam two double sets of steel rods reinforce the concrete. They are low in the centre, as shown in the illustration (Plate XXVII), and at the points of support the upper rod rises and passes over the support on the upper part of the beam, where there is a short horizontal rod. The slant upwards of the upper rod to the upper part of the beam to form almost a triangle over the point of support is the result of close calculation of the relative parts of the beam that are in tension and compression. For example, with a beam designed to carry a fair load the greatest tensional strength is required on the under side of the centre of the span below the neutral axis where the two rods reinforce. Conversely the greatest compressive strength is required on the upper side on the centre of the beam, which is mainly solid concrete. Tensional strength, but to a less extent, is required above the points of support where the upper rod slants upwards to the upper part of the beam. Round the rods are vertical stirrups of hoop iron, placed at intervals which lessen towards the supports. They perform somewhat the function of the web in the R.S.J., the rods corresponding to the flanges. It will be seen from the diagrams that the beams and pillar supports and floor are all tied together at the joints by crossing bars, while in this system the rods in both columns and beams are continuous where they cross, thus making a monolithic framework which recent investigations have shown is the strongest possible structure. This is the simplest basic construction, and there have evolved from it many diverse and elaborate structures which will claim attention later.

In Coignet's system single rods run at the top of the beams, while bunched rods are near the under side in the centre of the span, which, with the exception of one, bend upwards at intervals towards the support and are tied to the upper rod. The rods do not run through where columns and beams cross, as in the Hennebique method, but short rods connect the beams on either side of the column, and the columns above and below the beams. In both systems the column reinforcement is similar, with four vertical rods at the corners, but in Hennebique's the rods have separate binding, and in Coignet's they are spirally bound.

The distinctive feature of Considère's system is the method of spiral reinforcement. In columns this is a particularly strong reinforcement and consists generally of not fewer than six vertical rods held together by a spiral binding. There is also spiral reinforcement in beams and arches. It is interesting to note that in this method spiral reinforcement is placed in the areas of compression on the under side of the beams near the supports. It is in Considère's method that the ends of rods are hooked so as to obtain a hold on the concrete.

The majority of early buildings in reinforced concrete were mainly industrial, like factories, grain silos, warehouses, and railway constructions. Its employment in buildings where architecture is more a conscious purpose was more gradual. Many European industrial buildings were built of reinforced concrete in the first decade of its extensive adoption, that is, from about 1894 to 1904, and the majority of these buildings were constructed by the Hennebique method. Among them may be mentioned grain silos at Brest, Strasbourg, Genoa, and Dunston-on-Tyne; the electric power station at Basle; large factories like the Marconi Factory at Genoa, and many warehouses for railway companies, including British companies. These buildings express in their appearance, somewhat timidly perhaps, the method of construction. Some of the interiors hold promise of new architectural effects resulting from the new construction.

Buildings of a more ceremonial character constructed of reinforced concrete during this first decade have generally a more traditional appearance and reveal their construction less. Among them are the Hotel Gallia at Cannes, the Hotel Imperial at Nice, the New York Fire Insurance Company at Paris, a theatre at Lille, the Court House at Messina, and the Hospital Major at Turin. During this period Hennebique built a reinforced concrete house at Bourg-la-Reine, in which he tried to demonstrate the possibilities of his method of construction. The design includes cantilevering of upper floors, and a generous provision of roof gardens.

A noteworthy early expressive use of reinforced concrete appears with Anatole de Baudot's church of Saint-Jean l'Évangéliste, Montmartre, built in 1894. It is constructed of a reinforced concrete frame with thin walls between. The piers and arches of the interior are part of the frame and contribute largely to the decorative character of the church.

Auguste Perret, with whom his brother G. Perret is associated, was one of the first architects to use this method of construction extensively. He used it expressively, so that it determines very largely the design and appearance of his buildings. His first work is the house at 22 Rue Franklin, Paris, where he used a slender reinforced concrete frame, quite adequate for its purpose, as time has shown, but which made the authorities and others apprehensive that it might collapse. The tall, narrow façade of the building, with long, vertical lines, clearly expresses the construction. Another early work of Perret is the garage at Rue de Ponthieu, built in 1905 (Plate XXVIII). Here the reinforced concrete frame again determines the design of the façade, which anticipates numerous later buildings, with its square frame and large areas of glass between; while the interior of the garage shows a ferro-concrete balcony construction with post supports that forms the prototype of much that came later.

Reinforced concrete was employed in the buildings for Tony Garnier's 'Cité Industrielle', which was designed in 1901–4. This 'Cité Industrielle', although remaining but an idea, has had considerable influence on town planning (with which I will deal briefly later), but its present pertinence is that this exercise in ferro-concrete designing laid the foundation of much of Garnier's future practice. Some of the constructions in this scheme, such as that for the Central Railway Station, incorporate developments which were not to be realized until later. As this plan was not published until 1917,[1]

[1] Tony Garnier, *Étude pour la construction des villes* (Paris, 1917).

it is possible that Garnier made additions and modifications in the interval.

With the second decade of extensive development of reinforced concrete construction, that is, from about 1904 to 1914, we pass from the pioneer stage to established and confident practice. During this period numerous improvements and elaborations are introduced in the frame method, more complex structures are achieved, while new methods of considerable importance are developed, the principal of which are the slab and column method (in contrast to the frame), developed by the Swiss engineer Robert Maillart; parabolic vaulting developed by Freyessinet; and, a little after this period, a method of constructing domes and barrel-vaults first developed by Dischinger and Bauersfeld, known as shell concrete and sometimes referred to as the Zeiss-Dywidag method derived from the names of the firms for whom these engineers worked. The development of the last-mentioned method occurred in the nineteen-twenties, so that its description will have to be deferred until that period is reached.

It must be remembered, however, that although alternatives to the Hennebique, Coignet, and Considère methods began to appear before 1919, they did not represent any extensive practice, and the three methods of frame construction almost, if not quite exclusively, held the field. There were a large number of buildings erected in France, Germany, Holland, Switzerland, and Italy in which these methods were used. Among them may be mentioned the famous Queen Alexandra Sanatorium at Davos, built in 1907. In this building Pfleghard and Haefeli were the architects, François Hennebique was the engineer, and Robert Maillart the contractor.[1] The principal façade with the sun balconies has the appearance of an all-over pattern of squares, formed by the ferro-concrete frame. It is a type of hospital construction that was later followed extensively. Auguste Perret continued to work on the frame principle, and to this period belongs his famous Théâtre des Champs-Élysées (1911–14) (Plate XXVIII). The exterior of this building expresses less of the new construction than Perret's two earlier works mentioned. The frame structure has clearly influenced the design, but it is encrusted with marble and has a somewhat restrained Renaissance dressing with its decorative sculptured panels. The interior appearance is

[1] Siegfried Giedion (op. cit., p. 372) speaks of Maillart as a pupil of Hennebique and refers to Maillart as the engineer and Hennebique the contractor in this building. P. Morton Shand, on the contrary, in his article on Maillart in the *Architectural Review* of Sept. 1940 speaks of Maillart as the contractor and Hennebique the engineer. Shand records that Maillart first set up as a contractor, and went to Russia just before the First World War. After the war, having lost all his money, he returned to Switzerland and set up as an engineer.

more decisively influenced by construction, especially in the vestibule with its frame pattern ceiling and column supports; but the beautiful part of the interior is the long, unbroken curve of the balcony front, which gives rhythm and distinctive character to the whole. The frame construction employed is a combination of the Hennebique, Coignet, and Considère methods. The spiral binding of the rods in the square uprights follows Coignet, while the spiral binding of the circular columns follows Considère.

These frame constructions are obviously similar in principle to the post and lintel construction that we find in ancient buildings, and which was brought to architectural perfection in ancient Greece. Again, numerous medieval buildings and modern houses, built with the timber frame, follow the same principle of construction. We have seen in the evolution of the steel frame that it emerged from the cast-iron column supporting the iron beam in the floor, and this was repeated on each floor. Linking it into a continuous frame, whether of steel stanchions or reinforced concrete beams and piers, gives the added strength of the monolithic frame.

With the method introduced by Robert Maillart a different principle is involved. It is employed both in his industrial buildings and bridges. Reinforced concrete is used, not as a frame construction, but principally as a slab construction, with columnar supports where necessary. An early example of this type of construction appears in a bridge built in 1906 over the Upper Rhine, at Tavanasa, in the Grisons (Plate XXIX). A flat concrete slab forms the deck or platform of the bridge, which is supported by a vertical slab, the bottom edge of which is shaped as an arch and pierced at the sides. It is an amazingly plain and simple structure. The beautiful line of the arch is accentuated by the piercing which helps to give the feeling of thrust, and thus vigour and life to the design. P. Morton Shand most aptly describes its form as 'suggestive of a pair of skates joined toe to toe with a thin sole running along the top of their blades: a form of surprising lightness and grace completely alien to all preconceived conceptions of that solidity of appearance which used to be deemed the cardinal aesthetic criterion of any fine bridge'.[1] Unfortunately the bridge was destroyed by an avalanche in 1927. As we shall see later, this method of slab construction was employed in many of Maillart's bridges built between the wars.

Maillart used the method of slab construction supported by columns in a warehouse at Zurich in 1908 (Plate XXIX). Each floor is a continuous slab without frame construction and is supported by octagonal columns with spreading capitals. These capitals are reinforced by rods which spread laterally and by support rings, which in turn support the slab or floor rods. This method is generally known as mushroom-slab construction, first so-called in Germany, being a translation of the German term *Pilzdecke*. About the same time a similar method was first employed in America by the engineer C. A. P. Turner. This method differs from that of Maillart in that a panel or slab, like the Greek abacus, appears between the capital and the ceiling. The Turner system is much heavier and bulkier than that of Maillart, which has proved to be susceptible of several refinements. Maillart continually experimented with the method and used it for many industrial buildings. In 1910 he made an experimental model structure (Plate XXIX), and in 1913–14 he used the method in a cardboard factory at Lancey in France (Plate XXIX), where he had circular columns instead of octagonal. Here the columns are more slender and the curved capitals merge almost imperceptibly into the slab roof. We shall see later how much modern reinforced concrete construction, especially in industrial buildings, owes to the early work of Maillart.

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[1] *Architectural Review*, vol. lxxxviii, Sept. 1940. This is an appreciation written shortly after Maillart's death in 1940. See also *R.I.B.A. Journal*, Sept. 1938, pp. 957–69.

The reinforced concrete parabolic vaulted buildings, many fine examples of which were to appear between the wars, was first employed by E. Freyessinet in the airship hangars at Orly, which he built for the French Government in 1916 (Plate XXX). The illustrations show clearly the method of construction. The whole structure is a kind of long corrugated parabolic arch, with panes of glass let in the narrow strips between the arched members. Here the walls and roof are brought together in a continuous structure. It is a work pregnant with future developments and variations.

An interesting reinforced concrete construction, built in 1914, which deserves mention, if only for its dramatic size, is the Jahrhunderthalle at Breslau, designed by Max Berg. The most remarkable part of this building is the reinforced concrete dome, about 213 feet in diameter, thus of considerably greater span than any dome then in existence. The dome is constructed of heavy ribs of concrete with glass panels between. The bulk and weight of concrete seems now far too great and appears to have much of the bulk associated with masonry domes. A great advance in lightness was made some years later in constructing domes and vaults by the use of shell concrete.

By 1914 most of the progressive architects of Europe—Peter Behrens, Henri van de Velde, Adolf Loos, Hans Poelzig, Adolf Meyer, Walter Gropius, and others—were using reinforced concrete either partially or wholly for some of their buildings. Some mention of these buildings will be made in the chapter on the Foundations of the New Architecture.

CHAPTER XII

Architecture and Social Progress—Nineteenth-century Housing

THE social needs in which building, and consequently architecture, have their roots have been tacitly accepted in the accounts that have so far been given of the developments of architecture in the period before the First World War. We have seen in the earlier chapters, when dealing with the revival of architectural styles of the nineteenth century, that the majority of important buildings appeared in the dresses of remote styles, that their architecture had little relation to social needs, and that the dominance of the building by this stylistic architecture very often made it less serviceable in answer to the need for which it was built. We recalled the sighs of Schinkel for a living architecture when he visited the growing industries of the north of England, failing to recognize one of its beginnings in the cotton mills of Lancashire. We have noted how a domestic architecture of England, based on living purpose and available for a few of the discerning well-to-do, began with the revolt of William Morris and Philip Webb against the mechanical imitations that constituted contemporary architecture, and the soulless machine production of growing industrialism. We have noted, when tracing developments in construction, for which engineers were mainly responsible, that new types of building, like the departmental store, had come into being owing to increasing social requirements. But building that should meet the chief social needs, that is of small dwellings housing nine-tenths of the population of Europe, I have so far only briefly alluded to in a paragraph when discussing building of a more exclusively utilitarian character like factories and warehouses for which some architectural distinction can sometimes be claimed. I remarked, however, that the same cannot be said for industrial housing. Why is it that this building for the vast majority of the population has not appeared in the picture? Alas, for the reason already suggested, that very little can be called architecture, and that 'very little' belongs to the later years of the industrial period. It is a melancholy reflection that the dwellings of nine-tenths of the population of Europe in the nineteenth century were so mean, squalid, dreary, and miserable that a reference to them as architecture would probably be greeted with a smile that arises from satirical comment.

Why was this so? People crowded into the cities and towns to work in factories. They wanted living accommodation, so in response to this demand the value of land increased, and speculative builders were active providing dwellings that gave less than the bare necessities of decent shelter for as high a rent as could possibly be obtained. With the continual influx of the population, and its very rapid natural increase, the demand for accommodation greatly outstripped the provision of dwellings, and families crowded into existing houses. There was generally no supply of water in the houses; this was obtained from a communal pump or tap probably in an alley, and a privy similarly placed served for many houses. Thus, as industries expanded and industrialists became more prosperous, the congestion in cities became more and more acute, and the conditions of the workpeople became worse and worse, so that during the half a century between 1830 and 1880 the living conditions of the mass of the population of Europe reached a degree of meanness and squalor unequalled in history. Catherine Bauer[1] says that

> It must always remain one of the great historic ironies that the century which invented the notion of material progress, which unfolded more scientific possibility than all the preceding years of Western civilization put together, was also the century which debased human environment to about its lowest known level. If a civilization is the use to which an age puts its resources of wealth, knowledge, and power, in order to create a social life, then the nineteenth century as a civilization is a record of failure.

The evidence of the appalling living conditions of the majority of people of Europe during the nineteenth century is voluminous and depressingly convincing.[2] Nassau Senior indicates the irresponsibility of the speculative builder in Manchester in 1837, when he says that there was 'the utmost disregard of everything except the immediate advantage of the speculative builder'. 'A carpenter and builder', he continues, 'unite to buy a series of building sites and cover them with so-called houses. In one place we found a whole street following the course of a ditch, because in this way deeper cellars, not for storing wares or rubbish, but for dwellings of human beings, could be built. Not one house in this street escaped the cholera. In general the streets of these suburbs are unpaved, with a dungheap or ditch in the middle; the houses are built back to back, without ventilation or drainage, and whole families are limited to a corner of a cellar or a garret.'[3]

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[1] *Modern Housing* (Boston and New York, 1934), p. 7.

[2] Some of it may be read in Friedrich Engel's *The Conditions of the Working-class in England in 1844* (London, 1892). Harry Barnes's *The Slum. Its Story and Solution* (London, 1931), and in the evidence given to The Royal Commission on the Housing of the Working Class in 1884.

[3] Quoted by Catherine Bauer, op. cit., p. 15.

Lord Shaftesbury, in his evidence to the Royal Commission on the Housing of the Working Classes of 1884, described how he had seen dwellings in which the occupants lived over cesspools and swamps. In one dwelling, he says, 'there was boarding upon the floor: upon that boarding were living a woman and three children. We lifted up the boarding, and there was the open cesspool—not one foot below the surface of the room.' Thousands of examples of filthy living conditions could be given, and many exist to this day.

As buildings the majority of these dwellings had no merit. There was generally a somewhat different type of dwelling in the cities of England and the cities of most other European countries. It must be remembered that well into the nineteenth century many continental cities preserved the city defensive wall, whereas in England this defensive wall had generally been dispensed with centuries before, due to the circumstance of the country being more immune from attack by being completely surrounded by sea. In most European cities, as the population increased, there was a tendency for the city to expand upwards within the city wall, and this was effected by the building of high tenement blocks, so that an English visitor to Berlin in 1896 sees it 'as a tableland of bricks and mortar 72 feet high, cut up by intersecting valleys representing streets'. In English cities, on the contrary, the expansion took place outwards, and the type of dwelling was mainly the cottage and small house, although there was occasionally a slight expansion upwards when there were certain obstacles to horizontal extension, or when the lure of greater profit prompted higher dwellings. But it may be said that this broad distinction holds good throughout the nineteenth century. We shall see later, when considering movements towards better industrial housing, how the habits of thought born of these tendencies controlled many housing enterprises.

The majority of tenement blocks and cottages were erected by the speculative builder without the assistance of an architect. They are mostly totally devoid of any design, they are just boxes grouped together in bigger boxes built with the intention of packing human beings into them. No thought is given to the amenities of living. Middle-class tenements are better, but these are more often in the business and commercial areas of the cities, and some of the better types are the flats above shops on the main thoroughfares. The apartments above the shops in Haussman's boulevards in Paris, and in the main thoroughfares of other important cities, have the advantage of being planned by architects because the elevations of the blocks must be handsome in accordance with the handsome thoroughfare on to which they faced. But these are palaces compared with the tenement blocks of the industrial workers.

The improvements in housing effected in England by the Public Health Acts from 1840 onwards were of a minor character and wholly inadequate. It was during the middle of the century that the notorious back-to-back house was built in large numbers. The by-law planning and the type of dwelling accompanying it, which followed the Act of 1875, demonstrate vividly the contrast with continental housing. Rows of monotonous little houses at fifty to the acre, facing mean streets planned in the gridiron fashion, sprung up in thousands in every industrial city, and they still remain in most of the inner suburbs of the big cities. Many of these areas have become slums, and they differ from the older type of slum by being formal and monotonous in character. This by-law planning was not a very imaginative contribution to industrial housing (Plate XXXI).

The appalling living conditions of industrial workers stirred a desire among some progressive industrialists and social reformers to plan better living conditions for them. It should be emphasized that to provide better living conditions for the many is as much a matter of town planning as of building better houses; indeed the two cannot be separated. Thus we will find that in all the efforts of social reformers, these schemes are firstly matters of town and country planning into which the improved houses fit as small units in the whole. And in judging such houses architecturally we must take into account questions of town planning much more than we would in judging a large building like a church on an island site. We can isolate such a building a little from its surroundings for the purposes of contemplation, although the enjoyment of the building necessarily depends partially on a satisfactory setting. But with the small house, it is generally a unit which is repeated many times, and it is the ensemble of repeated units in relation to surroundings, which is the subject for aesthetic contemplation. Streets and suburban roads and the planning of whole residential areas must be considered. The difference for contemplation between a large building on an island site, and a small house which is a unit repeated in the contiguous building on either side, is somewhat like the difference between a picture on a wall which can be isolated for contemplation, although one is affected by a good or bad setting, and the pattern of a wall-paper which is repeated all over the wall.

English reformers and industrialists were among the first in planning better living conditions for industrial workers. This was largely because industrialization was developed much earlier in England than elsewhere, and the social evil of overcrowding was experienced earlier here than elsewhere. It was also due to a romantic tendency to turn from the sordid realities of the present to a better world of the imagination. The most noteworthy planning movement in England during the nineteenth century which culminated in the garden city was strongly tinged with this romantic tendency. That industrialists and social reformers sometimes took practical steps to realize this better world of the imagination did not make the tendency any the less romantic. We have noted before that many of the early vigorous stages towards an architecture more expressive of contemporary life originated with a romantic tendency to get away from sordid realities.

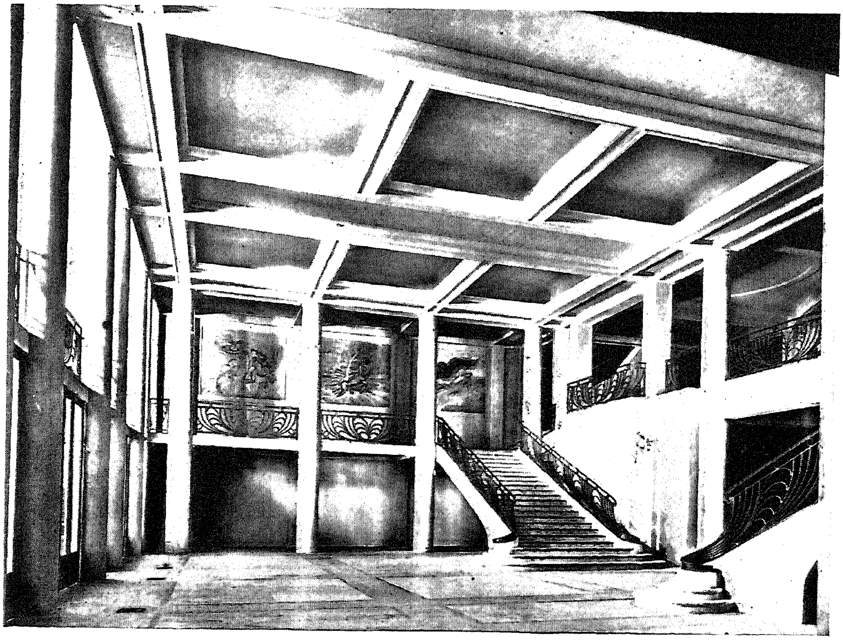
CHAPTER XIII

Architecture and Social Progress—Planning and Housing Developments

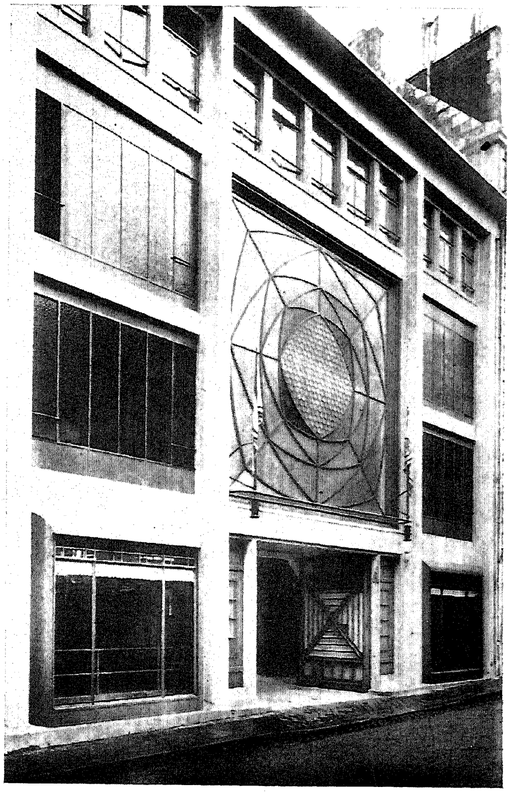
AFTER the Napoleonic wars many books and articles were written concerned with model houses for rural and industrial workers. Among the first publications of this kind was Richard Elsam's *Hints for Improving the Condition of the Peasantry*, published in 1816, in which designs for model cottages for rural workers appeared. In J. C. Loudon's *Encyclopedia*, referred to in Chapter XI, there were suggestions for improved housing. In 1844 some model dwellings were built by the Society for Improving the Conditions of the Labouring Classes, and from that time onwards most countries of Europe erected a few model dwellings for the poor. It is very much a reflection on the social conditions of the period that these model dwellings generally represent a low standard of accommodation. In the great exhibitions from that of 1851 onwards, there were generally exhibits of model houses, and reference has already been made to the interesting examples of the Paris Exhibition of 1869. But it was rather when housing was comprehended with planned environment that progress was made.

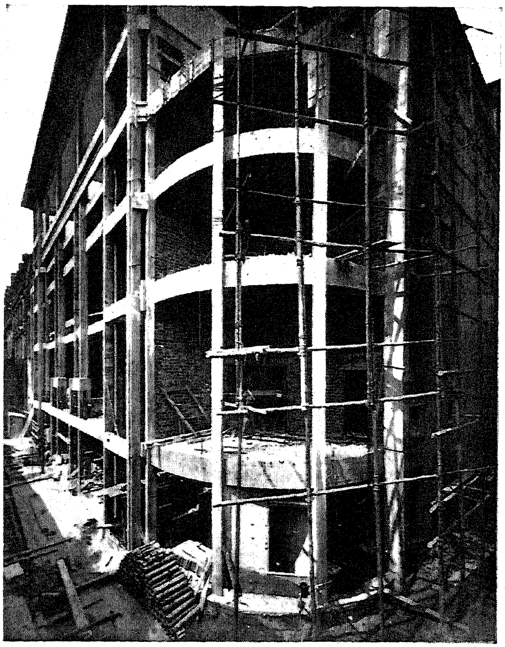
Many of the early planning ideas of the nineteenth century seen in restrospect appear as stages towards the garden city idea. The germ can be traced back to 1695, when John Bellers, a prominent Quaker, wrote a pamphlet in which he outlined a project for raising a College of Industry and in which some interesting planning suggestions were made. It is probable that this gave ideas to Robert Owen in his plan for villages of 'Unity' in 1818, included in his *Report to the Committee of the Association for the Relief of the Manufacturing and Labouring Poor.* These villages were to consist of 1,200 persons. The parents and children under three were to live in two-story houses, and for children over three dormitories were provided. The buildings were arranged round a square, in the centre of which were three buildings, the central one being a public kitchen and dining hall, the other two being planned for various social and cultural purposes. Each village was to be surrounded by 1,000 to 1,500 acres of land. A village on such lines was commenced at Orbiston, near Motherwell, in 1820, but the work was abandoned after a few years owing to dissensions among the promoters.

In 1845 a proposal to build garden villages on the outskirts of London



THE FOYER OF THE CHAMPS ÉLYSÉES THEATRE, PARIS (1914)



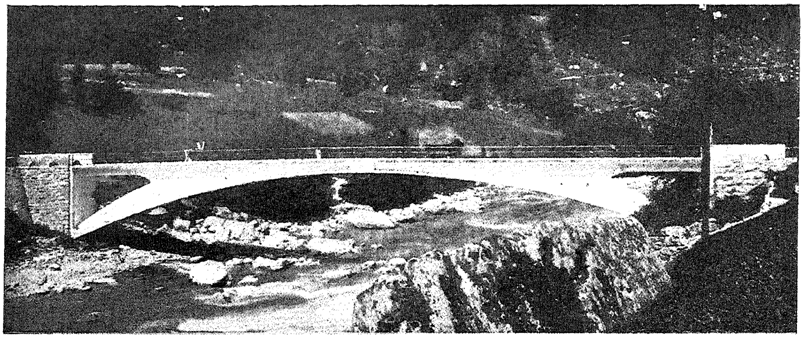


THE CHAMPS ÉLYSÉES THEATRE IN COURSE OF CONSTRUCTION

EXAMPLES OF EARLY WORK IN REINFORCED CONCRETE BY AUGUSTE AND G. PERRET

GARAGE, RUE DE PONTHIEU, PARIS (1905)

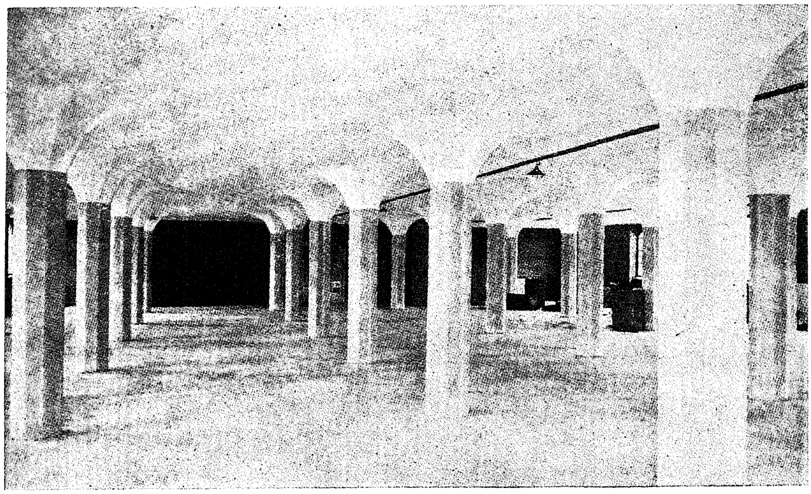
PLATE XXVIII



An example of slab construction in bridge design

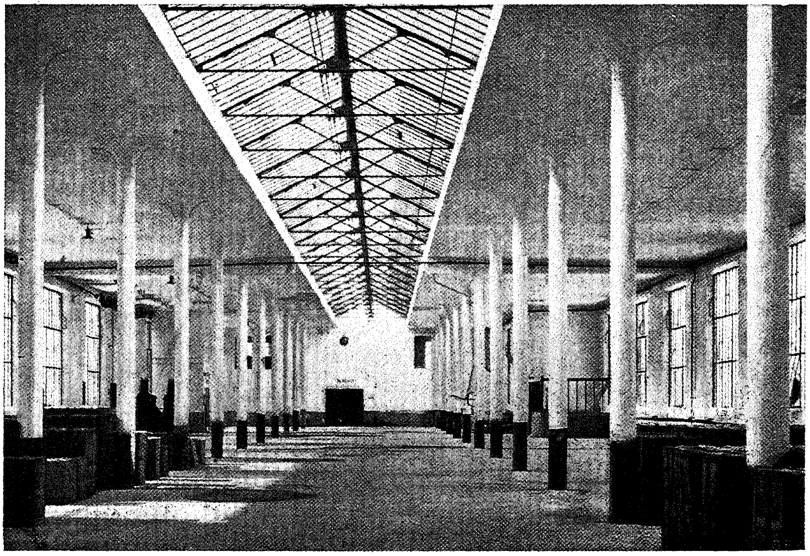
BRIDGE OVER THE UPPER RHINE AT TAVANASA (1906)

Designed by ROBERT MAILLART



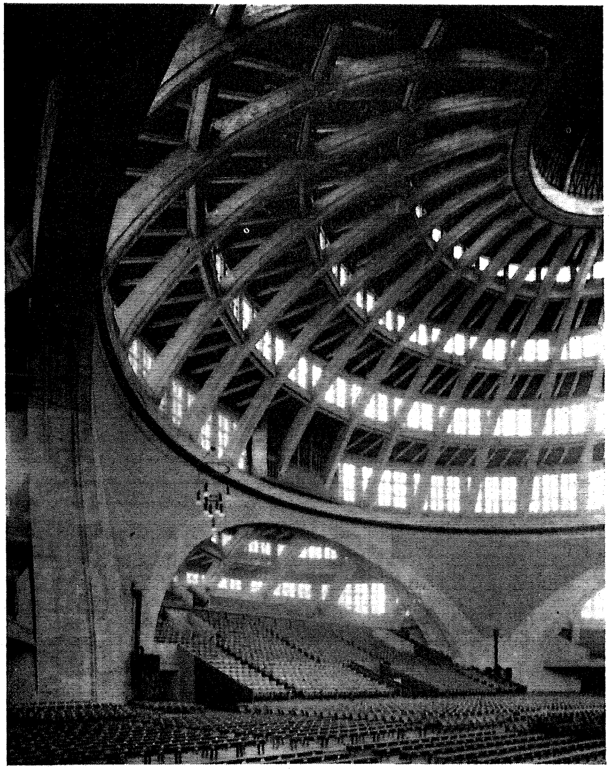
WAREHOUSE AT ZURICH (1908)

CARDBOARD FACTORY AT LANCEY, PARIS (1914)



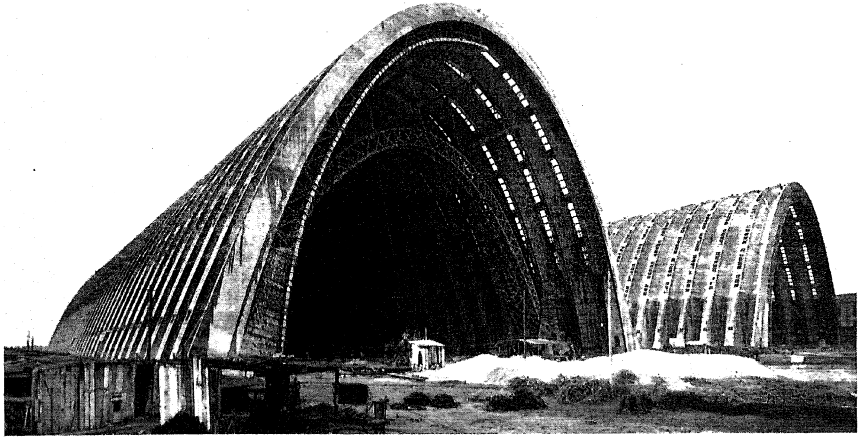
Reinforced concrete used as slab construction with columnar supports. Examples of work by Robert Maillart

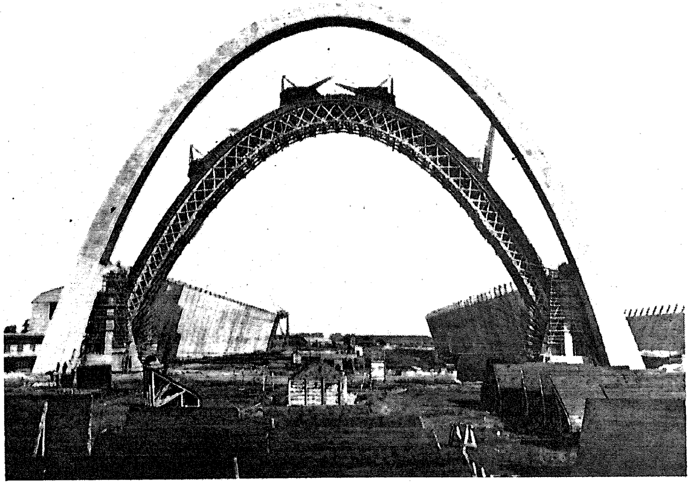
PLATE XXIX



JAHRHUNDERTHALLE, BRESLAU (1914)
Architect: MAX BERG

The reinforced concrete dome is 213 feet in diameter



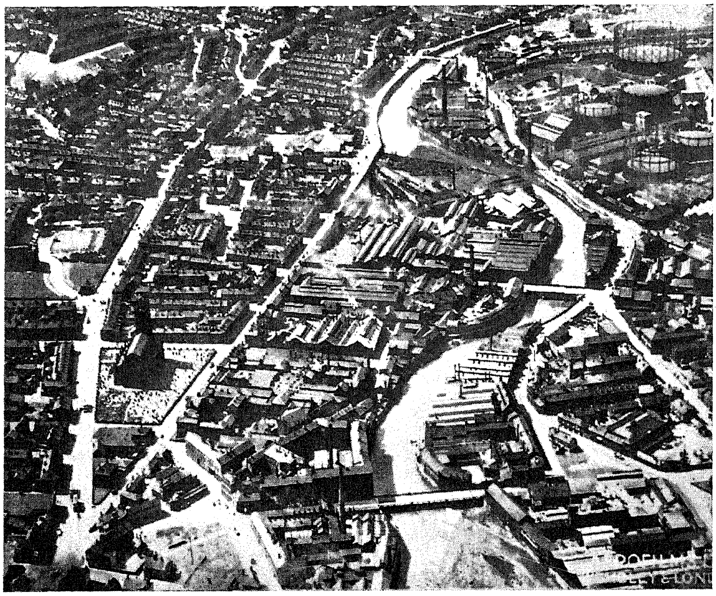


The first example of reinforced concrete, parabolic vaulted building, by E. Freyssinet

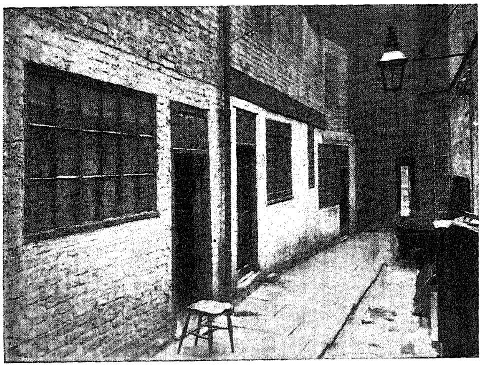
THE AIRSHIP HANGARS AT ORLY, FRANCE

VIEW OF THE SAME HANGARS TAKEN DURING CONSTRUCTION

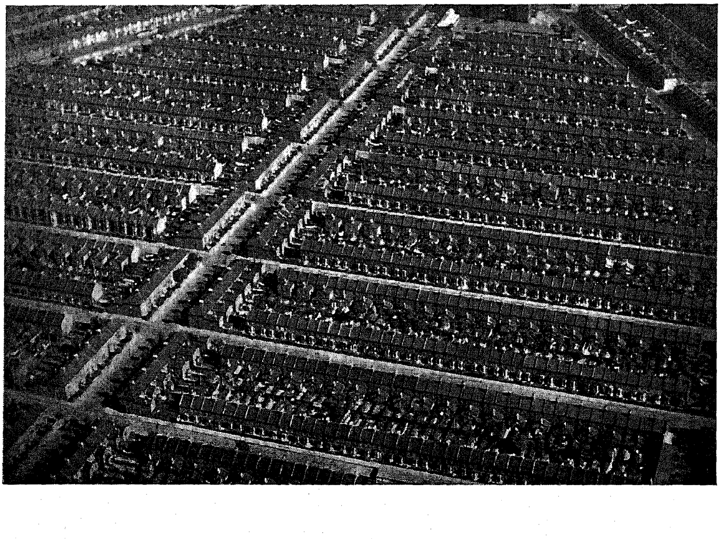
PLATE XXX



A COMPLETELY UNPLANNED INDUSTRIAL AREA, WITH HOUSING INDISCRIMINATELY MIXED UP WITH FACTORIES AND WAREHOUSES



COTTAGES BUILT BACK-TO-BACK WITH OTHERS IN ADJOINING COURT. NO THROUGH VENTILATION



THE FIRST EFFORTS IN PLANNING AFTER THE PUBLIC HEALTH ACT OF 1875—MONOTONOUS AND COMPLETELY UNIMAGINATIVE REGIMENTATION

Nineteenth-century industrial areas in England. These were the conditions that the early pioneers in working-class housing sought to improve

PLATE XXXI

was made by an architect named Moffat, and there was a project for one such venture near Ilford Station, but this did not mature. More famous was James Silk Buckingham's idea, put forward in a book entitled *National Evils and Practical Remedies, with a Plan for a Model Town*, published in 1849. This town, which Buckingham called 'Victoria', was for 10,000 people and was to cover 1,000 acres in the centre of an area of 10,000 acres. Like Owen's village it is planned in the form of a square, the houses being arranged on the sides of the square and graduated according to social classes. The richest were to live round the central square, and they were to have the largest houses and gardens. The others were graduated outwards so that the poorest lived towards the outskirts of the town, where also were the factories. The public, social, and administrative buildings were arranged in the same formal and symmetrical manner near the centre. Some amusing architectural features characterize the scheme. The rows of dwellings were to have colonnades. The outer colonnades for the poorer people were to be in the Gothic style, the next were to be Doric, the next Ionic, the next Corinthian, and lastly the dwellings in the centre were to have the glory of a colonnade in the Composite style. The whole, dwellings, colonnades, and everything, were to be built of iron. Thus tradition and progress were to mingle to create perfection. The valuable and noteworthy aims of Buckingham's plan were that a town was to be built to a preconceived design and not grow haphazardly; that it was definitely limited in size so as to be permanently surrounded by country; all the land and buildings were to be in single ownership, and all residents were to have shares in the limited liability stock company. Buckingham's plan was never put into execution, it remained but an idea, but it was a valuable contribution to planning and its influence has been apparent in later schemes.

In the same year that Buckingham published his plan of a model town, Charles Fourier published in Paris a book called *Cités Ouvrières: Des Modifications à introduire dans l'architecture des villes*, in which he proposes a plan for a community of 1,620 people. It was very much the idea of a philosophical theorist and was to consist of a group of palatial buildings inspired by classical architecture, with considerable attention to cultural facilities and the delights of the mind.

Many other plans and suggestions for model towns were put forward during the latter half of the nineteenth century. (They were generally on a higher level than the ideas for model houses.) They are not sufficiently important to be dealt with here, although many of them were contributions to the general progressive movements towards better planning and housing.

They culminated in perhaps the two most important contributions to the subject in modern planning, namely, Ebenezer Howard's Garden City and Tony Garnier's Cité Industrielle, both of which were being worked out about the turn of the century.

So far I have dealt mainly with ideas that did not get beyond theory, but many ideas of industrialists themselves for improved living conditions and industrial housing became interesting and progressive enterprises. The first of these was Saltaire, a small community planned according to the ideas of Sir Titus Salt, a manufacturer of alpaca cloth. Salt built a large factory surrounded by the homes of the workpeople on a tract of land on the banks of the Aire, near Shipley in Yorkshire. It was commenced in 1851 and the first portion was completed in 1853. He was inspired by Disraeli's ideas expressed in *Coningsby* and *Sybil* published in 1844 and 1845. Readers of *Coningsby* (Book iv, chap. 3) will remember that Mr. Millbank built a village near his factory or mill which was 'remarkable for the neatness and even picturesque character of its architecture, and the gay gardens that surrounded it. On a sunny knoll in the background rose a church in the best style of Christian architecture, and near it was a clerical residence and a school-house of similar design. The village, too, could boast of another public building: an Institute where there were a library and a lecture-room, and a reading-hall'. Mr. Millbank's clerk told Coningsby of 'the plans which Mr. Millbank had pursued, both for the moral and physical well-being of his people; how he had built churches, and schools, and institutes; houses and cottages on a new system of ventilation' and allotted gardens. The expression of similar ideas is found in *Sybil* (Book iii, chap. 8). Mr. Trafford built a factory consisting of 'a single room, spreading over nearly two acres and holding more than two thousand workpeople. The roof of groined arches, lighted by ventilating domes at the height of eighteen feet, was supported by hollow cast-iron columns, through which the drainage of the roof was effected'. Mr. Trafford built a village for his workpeople which included a well in every street, public baths, and schools.

It will be seen that there is some similarity between Disraeli's description of Mr. Trafford's factory and the factory at Saltaire described in Chapter VII. The cottages at Saltaire are described by Abraham Holroyd in his biography of Salt.[1] They are 'built of stone, lined with brickwork; they contain a parlour or living-room, a kitchen or scullery, a pantry and cellar, and three bedrooms; of the latter one is appropriated to the husband and wife, one to the sons, and the third to the daughters. Some of the houses are designed for larger families, and others for boarding houses. Each house has a separate yard, a privy, a coal place, and ashpit.' There are also public baths and wash-houses, a church, a library, and a philosophical institute with a museum and lecture-hall, and on the bank of the river is a park with cricket ground and bowling-greens. As mentioned in a previous chapter the architects of the buildings and houses were Lockwood and Mawson. The Italian Renaissance style with a touch of Baroque here and there, in which the principal buildings are designed, determines, for obvious reasons of harmony, the appearance of the houses, although they are kept very simple. Circular-headed windows with prominent keystones are common, and where there is a series of three arched windows together, they are separated by pilasters with capitals that have a faint commercialized reminiscence of Renaissance ornament. (Most Victorian middle-class houses, not in the Gothic style, have them.) The fronts of most of the houses in Saltaire are alined with the footways of the streets, but in some of the bigger houses there are small front gardens.

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[1] *Saltaire and its Founder, Sir Titus Salt, Bart.* (Saltaire, 1871).

Judged by the standards of nearly a hundred years later these houses would fall short of essential requirements for working people, while most of them appear as somewhat dreary, but compared with industrial housing throughout Europe in the eighteen-fifties, Saltaire represented a tremendous advance, and must have appeared to most industrial workers as something of a paradise.

Contemporary with the building of Saltaire in the eighteen-fifties, Charles Godin's industrial housing estate at Guise, in France, was built. It provided accommodation for his workers in the factories engaged in the manufacture of ovens and enamel vessels. In the planning of the buildings Godin appears to have been influenced by the idea of Fourier. Large tenement blocks are built in the form of rectangles surrounding a central court or light well, which in the earlier examples was covered in with a glass roof. Galleries on each floor run round on the interior side of the blocks facing the central court, and these give access to each apartment and are reached by stairs at each corner. The planning of these buildings represents a stage in development towards the design of many later tenement blocks in Europe. Like Salt, Godin thought of the social welfare of his workpeople, and in addition to providing them with accommodation much superior to the average at that time, he provided them with recreational and cultural facilities, so that the community at Guise includes a school, theatre, baths, café, and other such amenities.

The largest of housing enterprises in Europe undertaken by industrialists for their workpeople in the late nineteenth and early twentieth centuries was that of Krupps at Essen. The various colonies were begun in 1870, and by 1910 the Krupps works housing colonies accommodated 46,000 people. The oldest colonies, consisting of the districts called Westend, Nordhof, Baumhof, Schederhof, and Cronenberg were erected from 1870 to 1875. After 1893 the colonies of Alfredshof, Friedrichshof, Altenhof, Margarethenhof, Dahlhauser Heide, Emscher Lippe, and Colony Gaarden were added. Cronenberg, one of the earliest, is an example of very formal rectangular planning as the plan illustrated shows (Plate XXXIII A). It is clearly influenced by classical ideas of planning. The chess-board pattern is the basis, and formality, balance, and symmetry are important factors. The buildings consist mainly of three-story blocks with from about twenty to forty dwellings in each block. 'Throughout, each staircase gives access to six dwellings, each comprising a small landing with a separate front door.'[1] The buildings are constructed of stone and brick. As the plan shows, each tenement block is in the middle of a garden, and there is a central park for the colony.

Alfredshof, begun in 1894, was at first something of an experiment. All the colonies before 1893 consisted of tenement blocks. By 1894 the influence of English domestic architecture, chiefly as the result of the healthy concentration on purpose of the architects who followed Morris and Webb, was being felt on the Continent. But it was an architecture mainly of two-story, one-family houses, and the type as well as design began to be adopted in some quarters. Thus Alfredshof, largely as the result I think of English influence, was commenced as cottages. These cottages were for one, two, three, or four families; each family having its own private entrance and small garden. Cottages to accommodate 232 families were completed by 1899, when the building came temporarily to an end. It was recommenced in the colony in 1907, but by that time, owing to the extension of Krupps's works and the consequent increased demand for accommodation in the area, it was continued in several-storied flat buildings. This had been the provision from the beginning in Friedrichshof, where the blocks are arranged round courtyards kept as gardens.

A later colony is that of Dahlhauser Heide, built in the Bochum district for the miners of Hannover and Hannibal. Again there is an adoption of the cottage type of dwelling, for practically all the accommodation in Dahlhauser Heide is in semi-detached cottages. The irregular plan is very different from the formal plan of the earlier colony of Cronenberg. Here, as the plan illustrated shows (Plate XXXIII), the roads curve about the site, and one thinks rather of the medieval village than the classical city. This change in planning in Germany results partially from the diffusion of Camillo Sitte's enthusiasm for medieval planning, given in his book *Stadtebau* published in 1889, and partially from English influence where there is a similar diffusion of medieval thought resulting from the Pre-Raphaelites and William Morris. These influences are apparent not only in the changed planning of the communities, but in the domestic architecture. The first tenement blocks of Cronenberg are simple, with little ornament, as becomes their strictly utilitarian purpose, but at the same time they have a certain classic restraint. With the later tenement blocks of Alfredshof medieval influence is apparent in the introduction of picturesque effects, such as the high-pitched roof making a great expanse of tiles, the windows in the roofs, and the ornamental curves over entrances and windows. In some of the colonies traditional Dutch picturesqueness plays a part. In the cottages at Dahlhauser Heide there are the sharply sloping roofs, and decorative devices like shutters, and half-timber work in the gable ends are introduced, and the whole is characteristic of the very strong tendency of the time both in England and Germany of trying to recreate the medieval village.

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[1] *Guide to the Workman's Colonies* (Essen, Ruhr), 1911, compiled for The Garden Cities, and Town Planning Association. The sentence quoted is ambiguous, owing probably to the author's insufficient knowledge of English. The guide gives in a brief form much useful information about the colonies.

As domestic architecture, where the purpose has been to house the poorer strata of the population, Krupps's housing at Essen must be regarded as one of the best European examples before the First World War, and as a social achievement it is more important. Catherine Bauer[1] says of it:

> There is little housing in all Europe which is physically better than that of the Krupps. They had three acknowledged purposes: to attract the best workers and keep them efficient, to inspire 'filial loyalty', and to ensure that Essen itself should be a wholesome, attractive, and modern city. As for the last purpose, they succeeded quite remarkably. Their own large-scale construction served to heighten competition, lower speculative land prices, and raise the standards of purely commercial building. Their favourable attitude towards city and regional planning makes the Ruhr district to-day one of the most advanced and orderly regions in the world in this respect.

Contemporary with the development of the Krupps's housing colonies in Essen, Bournville and Port Sunlight in England were being planned and built. They provide two further examples of what had been done by Sir

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[1] Op. cit., p. 89.

Titus Salt at Saltaire. These English industrial housing estates differ, however, in many respects from the colonies at Essen. At Essen the colonies were developed in relation to steel and armament works and coal-mines; the housing is thus in an area of heavy industries. What was planned at Essen in the interests of good living conditions for the workpeople was elsewhere mainly a haphazard growth and an indiscriminate mixture of factories and houses, resulting in overcrowding and slums, which have been to some extent indicated earlier in this chapter. Germany being later to develop industrially than England had the advantage of profiting by some of the evil consequences of unplanned and haphazard growth of mixed industrial and housing areas.

Saltaire, Bournville, and Port Sunlight arose from the establishment of light industries in the country. These were not developments, like Essen, of essentially industrial areas by reason of access to raw materials; on the contrary they represented a break with the custom of building factories in the central industrial areas, and of building them instead in the country a few miles out. It was part of the general impulse, so strong in England at the time, to get away from the congested and often squalid industrial centres to the fresh air, green fields, woods, and streams of the country. These industrial estates were a valuable contribution to social progress, for in their planning an attempt was made to view social life as a whole, for in addition to providing healthier living conditions and social amenities, places of work are in satisfactory relation to homes. They were contributions towards the fuller social conception of the garden city, fuller because it had the scale and comprehensiveness that Bournville and Port Sunlight necessarily lacked.

The flight of the middle classes from the industrial centres[1] which created the sprawling suburbs was of a totally different character, and constituted a social development unsatisfactory in many ways. As these industrial areas became more congested, smoky, dirty, and squalid, the more well-to-do, finding their surroundings becoming less pleasant, escaped to the country on the outskirts of the town. This happened first in London, which had a population of over a million in 1800, and the process spread to other large cities in England where the defensive wall had long ceased to exist, and horizontal extension by means of suburbs was possible. In the rest of Europe, because the defensive wall was often maintained until the middle of the century, as before remarked, vertical extension by means of tall tenement blocks had been more the custom, and thus suburbs developed later than in England.

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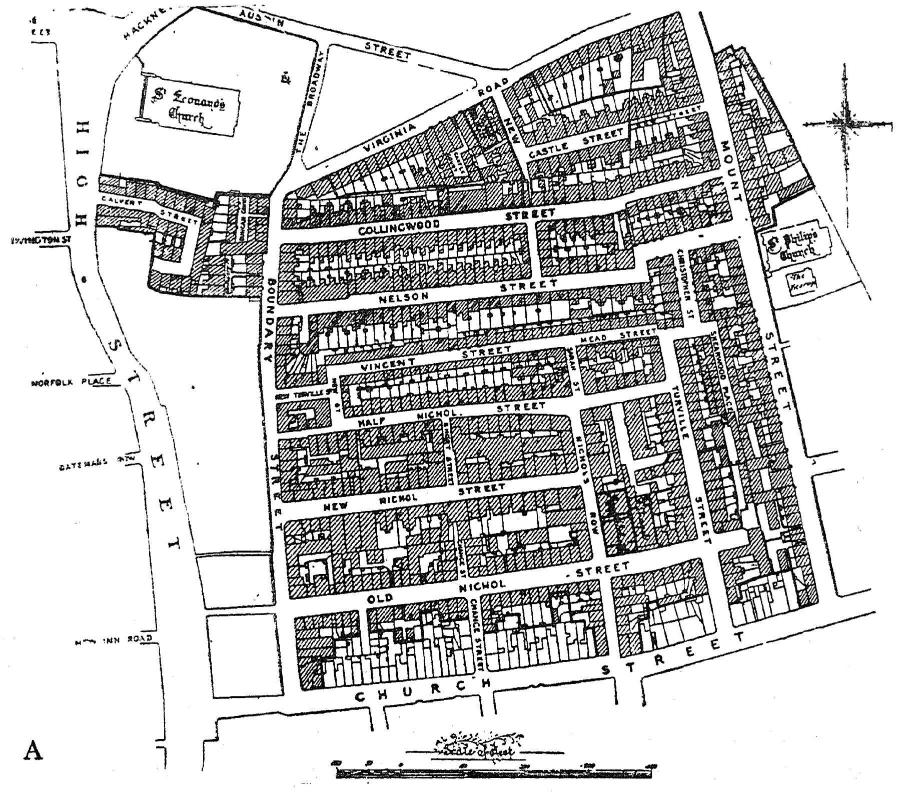
[1] This is dealt with at length in Lewis Mumford's *Culture of Cities* (London, 1938), pp. 210–22.

The escape of the middle classes to the country and the development of suburbs was not attended by any comprehensive planning where the part was related to the whole, it was mainly haphazard. London presents the greatest example of this growth in Europe. And as cities grew it meant that to get to the country one had to go farther and farther out, so that gradually we find some of the inner suburbs becoming overcrowded like the central areas, except where measures had been taken to prevent crowding, and the pleasanter suburbs are generally on the outskirts. Partial exception must be made in areas like the western parts of London, but even here there has been a gradual movement outward of residential areas, produced less by industry than by expansion of business from the City westward.

To argue that suburbs are the negation of good social planning is not to contend that suburbs viewed as isolated residential areas are not often well planned. Hampstead Garden Suburb is an example of good isolated planning; but suburbs are not good social planning because they are planning for a part and not the whole of life. Hampstead Garden Suburb was originally planned by its founder, Dame Henrietta Barnett, as a place where 'persons of all classes of society and standard of income should be accommodated'; but the proportion of poor people accommodated is almost negligible, and it has become almost exclusively a middle-class suburb, thus resulting to a considerable extent in that social exclusiveness and isolation which is the negation of social wholeness and unity. Architecturally, however, Hampstead Garden Suburb is one of the best things in housing that was accomplished in the decade before the First World War. I will, therefore, have occasion to refer to it again in stricter chronological order.

Although suburbs were produced mainly by middle-class escapism, they were fostered to some extent by official policy in rehousing. In rebuilding in overcrowded areas local authorities had to accommodate the persons displaced, and in high densities of 200 or 300 to the acre this was possible only by building blocks of flats. Later it was realized that such rehousing might be greatly assisted by reduction of densities and accommodating part of the population elsewhere. In England the Housing of the Working Classes Act of 1890 empowered the London County Council to provide dwellings for the working class either inside or outside the County. From the time of its foundation in 1889, the L.C.C. continued the work of the Metropolitan Board of Works which had begun to clear insanitary areas in 1875. The first of the really comprehensive slum-clearance schemes of



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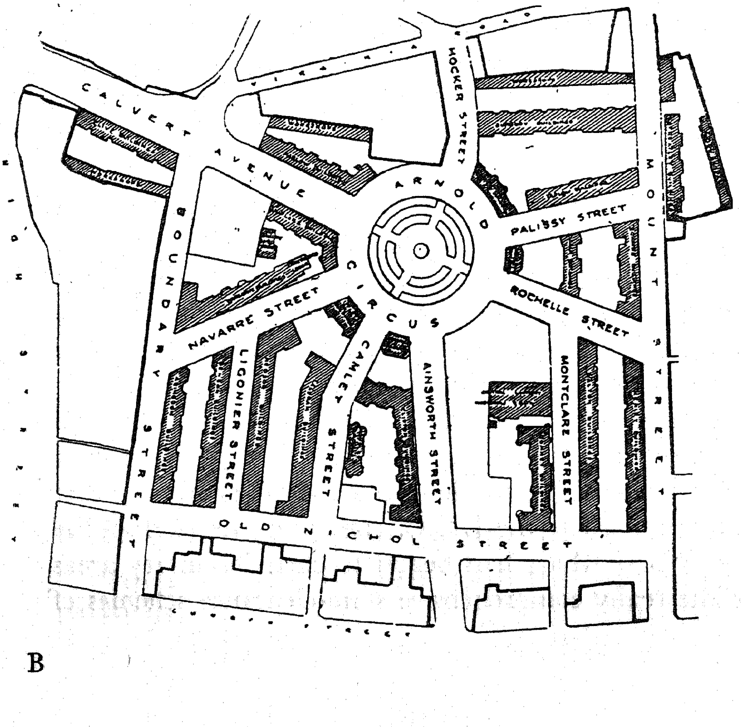

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PLATE XXXII

The first rehousing scheme undertaken by the London County Council was that of the Boundary Street area, Shoreditch, in 1890.

A. PLAN OF THE AREA BEFORE DEVELOPMENT.

B. AFTER BEING DEVELOPED.

(*Reproduced from* Housing of the Working Classes 1855–1912, *by courtesy of the London County Council*) the L.C.C. was that of the Boundary Street area of Shoreditch, which was carried out in the eighteen-nineties and completed in 1900. In this scheme it is worth noting that 5,719 persons were displaced and 5,524 were rehoused, leaving only 195 to go elsewhere. A glance at the two plans of the area will show how much more spaciously it is developed in the rehousing; but this, and giving improved and more spacious accommodation to almost the same number in the area, was accomplished only by building five-story blocks of flats. In building these flats economy was necessarily a paramount consideration, and architectural scope was, therefore, limited. The buildings are simple in appearance with restrained Elizabethan stylistic touches here and there, as in some of the gables, and the general effect is not unpleasing. The gardens that appear between some of the blocks enhance the general effect.

This is a typical rehousing scheme in a congested area of London. Although in this particular scheme nearly the same number were rehoused in the same area, and this was so in many other schemes,[1] in other cases much less accommodation was provided. In compliance with the powers under part III of the Act of 1890 the Council acquired sites for housing in suburban areas, like White Hart Lane Estate at Tottenham, and Norbury Estate to the north of Croydon, both of which were planned in 1901. The L.C.C. has continued this policy. It contributed to the development of suburbs, and to the process of adding to the urban sprawl which every year continued farther and unbrokenly into the country.

I cite the case of London because it is the biggest and worst example in Europe of suburban growth. What happened there happened also, but to a less extent, in the other big cities of Europe, in Glasgow, Liverpool, Manchester, Birmingham, Paris, Bordeaux, Berlin, Hamburg, Cologne, Vienna, Budapest. It was haphazard and unplanned in relation to the whole, it produced that uneconomic separation of people's homes from their places of work, because the suburb does not result from viewing social life as a whole. The planned exceptions to this are Saltaire, Guise, Essen, Bournville, Port Sunlight, the Garden City of Letchworth, and Tony Garnier's idea for an Industrial City.

Bournville[2] was an enterprise largely to provide better working and living conditions than were likely to be found very easily in the centre of Birmingham where the original small Cadbury factory was situated. 'Why should not the industrial worker enjoy country air and occupations without being separated from his work?' asks George Cadbury. He adds: 'If the country is a good place to live in why not to work in?' That: 'without being separated from his work' is one of the valuable social contributions that the suburb tended to defeat.

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[1] An account of the schemes up to 1912 is given in *Housing of the Working Classes* (London, 1913), published by the L.C.C.

[2] A well-illustrated brief account of Bournville is given in *Sixty Years of Planning: The Bournville Experiment* (1939).

The Cadbury factory was built near the Bourne stream, about five miles south-west of Birmingham, in 1879. The first few houses were built in that year for those who had to be near the factory, but only two of these now remain. The housing estate, called Bournville Village, was begun in 1895, and it has continued to be developed ever since. Originally the houses were occupied by employees of the Cadbury firm, but in 1900 a separate body called the Bournville Village Trust administered the estate, so that it ceased to be housing attached to a particular industrial firm. This was undoubtedly a step in social progress, for it is not conducive to the independence of a citizen that his employer and landlord should be the same person or institution.

In 1907 the estate covered an area of 500 acres, and it has since grown to 1,086 acres. The influence of the medieval village is strong in the planning of Bournville. With the exception of the principal main Bristol road, none of the minor roads are straight or formal, and curved roads and informal effects increase with later sections. There are plenty of open spaces, parks, and recreation grounds in central areas, while many of the houses back on to small recreation grounds or children's playgrounds. Facilities like schools are provided. Housing densities in Bournville are generally between six and twelve to the acre. The early cottages follow the type common in the late nineteenth century, with the kitchen and scullery projecting at the back. They are laid out spaciously, but are not of architectural interest. Some later houses are less stereotyped, and some built about 1907 on the Bournville Tenants Estate show the invigorating influence of Philip Webb, Voysey, and their followers, and are simple in treatment without ostentation, while materials are used expressively. The standard of more recent houses varies in excellence.

Port Sunlight[1] is the result of an enterprise similar to that of Bournville. It is smaller, covering in 1916 an area of 222 acres, on which about 2,000 houses are built. Many of the houses and cottages have some claim to architectural distinction. The factory, which lies to the south-east, was built in 1888, and since then the housing estate has continually developed. The plan is more formal than Bournville, and consists of a centre with straight, spacious avenues at right angles, and in the surrounding areas the housing plots are irregular rectangles and triangles. Back-yards, not individual gardens, are provided for the houses, but in the large area at the back of the houses are allotment gardens for communal use, an arrangement which I find is not so popular as the separate family garden adjoining the house. Medieval tradition has determined the design of most of the cottages and small houses. Picturesque effect has occasionally been the aim with some of the houses, and sham half-timbered work, due doubtless to the example of Norman Shaw, appears frequently. But there are some excellent designs where simplicity and directness and expressive use of materials are apparent, many of these being the work of some of the most competent of contemporary English architects.

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[1] A discursive and laudatory account of Port Sunlight is given in *Port Sunlight: A Record of its Artistic and Pictorial Aspect*, by T. Raffles Davison (London, 1916). The excellent illustrations of the book constitute its chief value.

Some of the early cottages, designed by W. Owen, were awarded the Grand Prix at the Brussels Exhibition of 1910. They are simple, brick houses, with decorative tiling in the gables and part of the first floor. An excellent group of small houses is in Greendale Road, designed by Sir Ernest George and Yeates. They are somewhat in the manner of Voysey's houses, for they have the same simple façades with large horizontal windows, and large, plain walls with white cement rendering. The interesting group of terrace cottages with a curved front, in Lower Road, designed by Sir Charles Reilly, affords an excellent example of combining a row of terrace houses satisfactorily into an architectural unity (Plate XXXIV B). In some houses stone is employed as a dressing for windows and doors, and in the examples at Pool Bank designed by Wilson and Talbot, late-Tudor square-headed mullioned windows are introduced effectively. In some other cottages in Pool Bank, designed by Douglas and Minshall, the ground-floor windows are treated in a similar way, and simple buttresses are employed, no doubt to make the late medieval reminiscence complete. It is in these compactly planned cottages, with simple but well-proportioned exteriors, designed between 1895 and 1914, that the chief architectural distinction of Port Sunlight lies, rather than in the pseudo half-timbered buildings, and the later classical buildings of the Art Gallery and bandstand in the central avenue called the Diamond.

Industrial housing estates like Earswick, near York, and Somerdale, near Bristol, have followed the examples of Bournville and Port Sunlight, and several others have been developed. Bournville and Port Sunlight are important, not only because they set an example to other later enterprises of a similar kind, but because they represented links between the ideas of Owen and Buckingham, and the Garden City organism first completely conceived by Sir Ebenezer Howard, and first realized in Letchworth. Also it is possible that they, with continental examples like Guise and Essen, had some influence on Tony Garnier's celebrated design for an Industrial City.

CHAPTER XIV

Howard's Garden City and Garnier's Industrial City

HOWARD'S idea of a garden city was first outlined in his book *To-Morrow: A Peaceful Path to Real Reform*, published in 1898.[1] The purpose of the book, as stated in the introduction, was to suggest a means whereby the continual influx of the population to the overcrowded cities might be arrested. 'It is well nigh universally agreed', he says, 'by men of all parties, not only in England, but all over Europe and America, and our colonies, that it is deeply to be deplored that the people should continue to stream into the already overcrowded cities, and should thus further deplete the country districts.' Howard quotes many famous men who point out the evil of this continued migration into the towns. Sir John Gorst said in 1891 that 'the interest and the safety of the towns themselves were involved in the solution of the problem'; and Dean Farrar remarked that 'if it be true that great cities tend more and more to become the graves of the physique of our race, can we wonder at it when we see the houses so foul, so squalid, so ill-drained, so vitiated by neglect and dirt?'

The causes which draw people into cities, Howard contends, may all be summed up as attractions, and the remedy lies in presenting greater attractions elsewhere. Each city may be regarded as a magnet, and the remedy is to provide a greater magnet. He defines both the town magnet and the country magnet, and then says: 'But neither the town magnet nor the country magnet represents the full plan and purpose of nature. Human society and the beauty of nature are meant to be enjoyed together. The two magnets must be made one.' He says later that 'town and country must be married, and out of this joyous union will spring a new hope, a new life, a new civilization', and he states that it is the purpose of his book 'to show how a first step can be taken in this direction by the construction of a town-country magnet'.

Garden City is the town-country magnet. In the hypothetical example the city is built in the centre of 6,000 acres, occupying about 1,000 acres for a population of 32,000. The balance of 5,000 acres forms a permanent green belt, mainly for agricultural purposes. The city is conceived diagrammatically as a circle, with six boulevards radiating to the centre, which is occupied by a garden of about five and a half acres. Surrounding the garden are public buildings: the town hall, concert and lecture hall, theatre, library, museum, picture gallery, and hospital. Beyond these is a public park of about 145 acres, which is encircled by a wide glass arcade, which Howard calls the 'Crystal Palace', which can be an attractive resort in wet weather. Part of it is designed for shopping and part as a winter garden. Surrounding this arcade is 'fifth avenue', lined with trees, on the farther side of which are houses. The next circular road is 'fourth avenue', and then 'grand avenue', the total width of which is 420 feet. Schools with their playgrounds, and churches, occupy sites in the centre of 'grand avenue'. The last and outer ring forms the industrial area, with a circle railway near by. The whole is shown clearly in the diagram (Plate XXXV) which first appeared in Howard's book.

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[1] A second edition was published in 1902 under the title *Garden Cities of To-morrow*. A third edition, edited by F. J. Osborn, was published in 1946.

The scheme has obvious physical similarities to Buckingham's 'Victoria', but it has considerable social and political differences as Howard is careful to point out.[1] In Buckingham's scheme the whole town is owned and controlled by a company that is responsible for all industrial undertakings, and there are several prohibitions like the exclusion of intoxicants. It is really subject to a benevolent despotism which claims to know what is good for the people better than they know themselves. Howard's scheme, on the contrary, allows for free enterprise and association of all kinds, and imposes no undemocratic restrictions on its inhabitants.

The revenue of Garden City is derived from rents. The return on capital invested is limited to 4 or 5 per cent., the remainder being devoted to the development of the city. One important ideal is that the ground is collectively owned by the inhabitants.

Provision is made for an increase of population above the planned limit of 32,000. 'It will grow', Howard states, 'by establishing another city some little distance beyond its own zone or country so that the new town may have a zone of country of its own.' He continues: 'This principle of growth —this principle of always preserving a belt of country round our cities would be ever kept in mind till, in course of time, we should have a cluster of cities . . . grouped around a central city that each inhabitant of the whole group, though in one sense living in a town of small size, would be in reality living in, and would enjoy all the advantages of, a great and most beautiful city.' He thinks of the central city as slightly larger, with a population of about 58,000.

I have quoted at some length from Howard's book because of the social importance of the idea. It is one of the most important contributions to town planning, conceived primarily in its social aspect, that the nineteenth century has given us, and it is, as far as I know, the greatest English contribution to town planning of modern times. The idea has been realized twice, not perfectly, but sufficiently to incorporate essentials: in Letchworth, commenced in 1903, and in Welwyn, commenced in 1920.

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[1] pp. 110–12.

The garden city idea has often been criticized as not being sufficiently comprehensive, and of not solving the problem of the big city. It is too early to say whether it is the most successful method of avoiding the anti-social haphazard growth of overcrowded cities. To those who say it does not solve the problem of the big city it might be replied that economic and social developments may make the big city an anachronism, and its gradual disappearance and the substitution of garden city clusters may be the most serviceable development for economic and social life of the future. But I will postpone consideration of this until developments of the 1919–39 period are studied. It must be sufficient here to emphasize that the garden city satisfies most social requirements of the full life. The town is sufficiently small for the country to be within easy reach of the inhabitants, yet sufficiently large to support the amenities and cultural facilities of town life such as schools, halls, libraries, theatre, exhibition galleries, community centres, and good shopping centres, amenities that will be more fully provided as social life develops. A town of 10,000 would be too small to support most of the amenities of town life, whereas a town of 30,000 can more adequately do so. Some would say it should be 50,000, others 100,000,[1] but these are differences of degree rather than of principle. The garden city is designed so that people who work there live there. The green belt can provide fresh food for the town, so that the farmer has a market near at hand. It must be insisted that it is the great merit of the garden city and the garden city cluster that it is the most successful attempt so far made to plan for social life as a whole in all its many aspects. No progress between the two wars has been made in advance of this conception. In fact, the fuller realization of the idea is held by a large number of sociologists as the essential requirement of planning. They are fortified in their conviction by the success of the two existing examples.

To-Morrow evoked fairly widespread response and hardly more than six months after its publication, in June 1899, the Garden City Association was formed to propagate Howard's ideas. It was felt by the Association that steps should be taken to put the ideas into practice, and that land should be secured and a garden city built. In 1902 the Garden City Pioneer Company was formed, which secured the Letchworth estate. First Garden City, Ltd., was formed in 1903 to promote the development and the pioneer company was dissolved. The work of planning Letchworth, the first garden city, was entrusted to Sir Raymond Unwin and Barry Parker.[1]

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[1] In Sir Patrick Abercrombie's *Plan for Greater London* (London, 1944), the maximum size of the proposed eight new towns is 60,000.

Application of the theory to an actual site produced something very different from Howard's diagram. The first garden city is built on a site that includes the villages of Letchworth, Willian, and Norton. The total area is about 4,500 acres, of which about 1,500 acres will ultimately be occupied by the town and 3,000 acres by the rural belt. The planners have taken advantage of natural features, with the result that there is a very irregular demarcation between the town and the rural belt. The chief factory area lies to the east of the town on either side of the railway which runs E.N.E. from London. The centre of the town is formally planned, with a principal thoroughfare—Broad Walk—running almost north–south, forming the main axis. The remainder is irregularly planned in the tradition of the English medieval village (Plate XXXV). In or near the centre are the town hall, grammar school, museum, a concert hall, theatre, and an educational settlement; and here also is the principal shopping area. The educational settlement is mainly for cultural activities for adults, and is a form of community centre. Places of worship and cinemas are adequately provided, but unfortunately there are no public-houses, as the inhabitants have consistently and undemocratically outvoted a substantial minority. There is a generous provision of open spaces, both as parks and for recreation. Most of the roads are lined with well-selected ornamental trees, and many of the footways are separated from the roads by a grass verge. The houses are for various grades of income, from the poorest to the well-to-do, and all have gardens in relation to their size. The general impression of the residential part is of a town set in a garden.

What is the architecture that emerges from this social experiment? Considering the period before 1914, the houses, like those of Port Sunlight and Hampstead Garden Suburb, develop from the medieval tradition through the minds of architects like Norman Shaw, Philip Webb, Voysey, and their associates. They vary in excellence. Many of the best are by the planners Sir Raymond Unwin and Barry Parker, where simple and direct effects are achieved with expressive use of materials as in pairs of houses at Lollershott West and on Letchworth Lane. There are similarly good houses by Bennett

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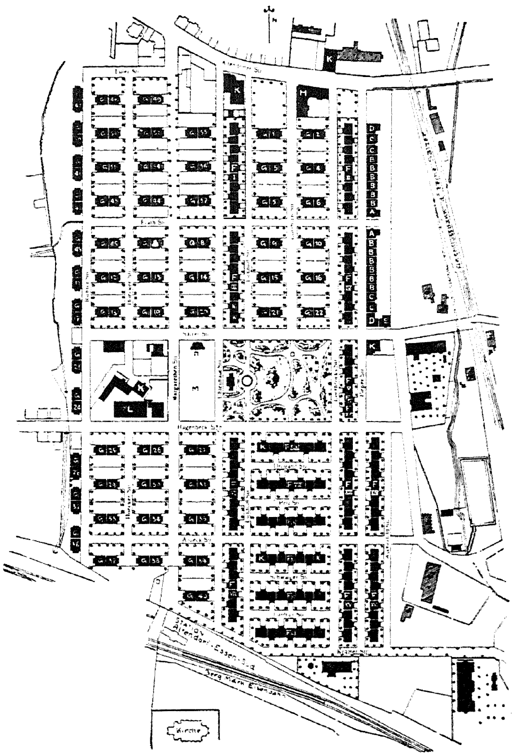
[1] A full account of the genesis and early development of the first garden city is given in *The Garden City*, by C. B. Purdom (London, 1913).



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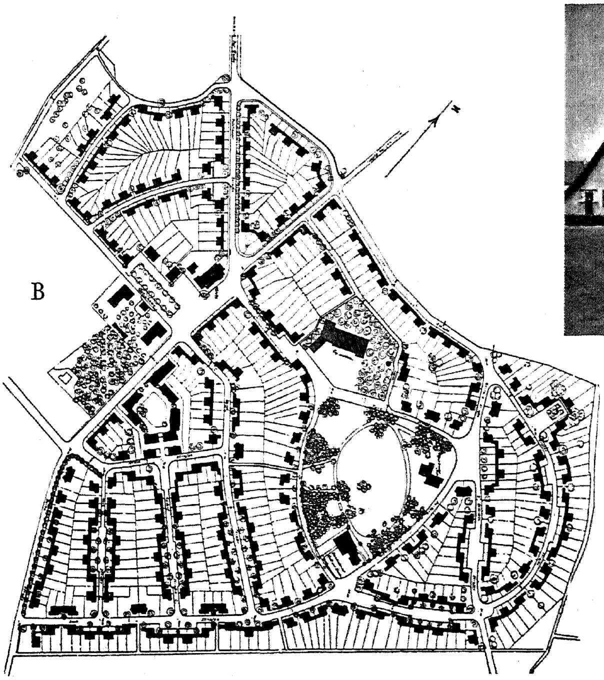

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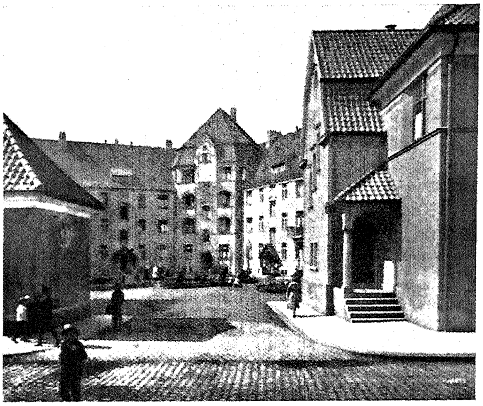

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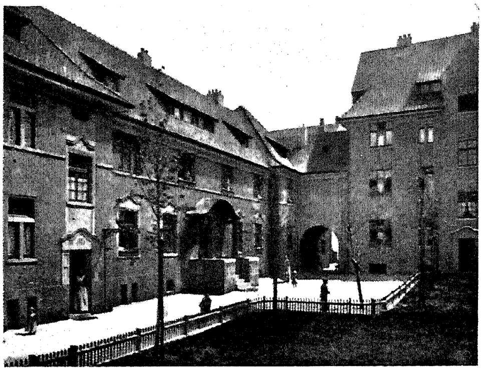

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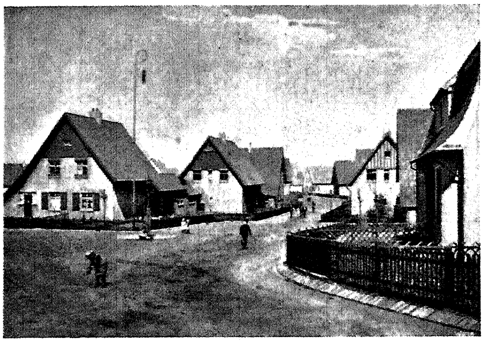

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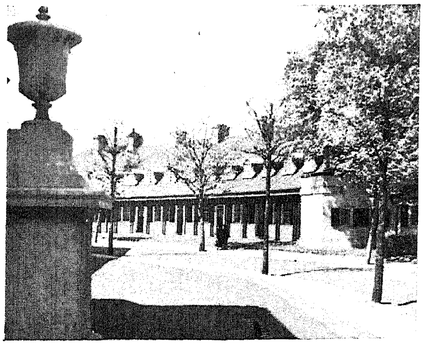
- A. PLAN OF CRONENBERG, ACCOMMODATING 1,454 FAMILIES (*c.* 1875)
- B. PLAN OF DAHLHAUSER HEIDE FOR 510 FAMILIES (1907)
- C. COURTYARD IN THE ALFREDSHOF COLONY (*c.* 1900)
- D. COURTYARD IN THE FRIEDRICHSHOF (*c.* 1900)
- E. A VIEW OF DAHLHAUSER HEIDE (1907)

Krupps, at Essen, began in 1870 the building of a number of colonies of workers' habitations

PLATE XXXIII



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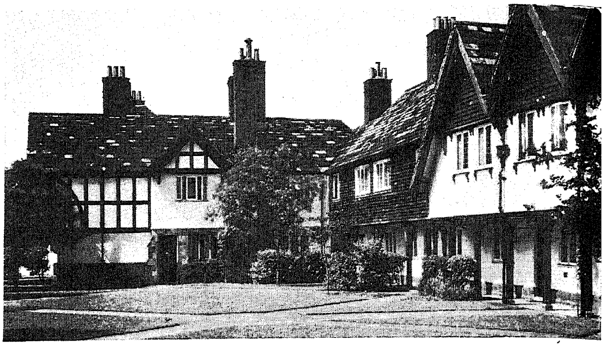

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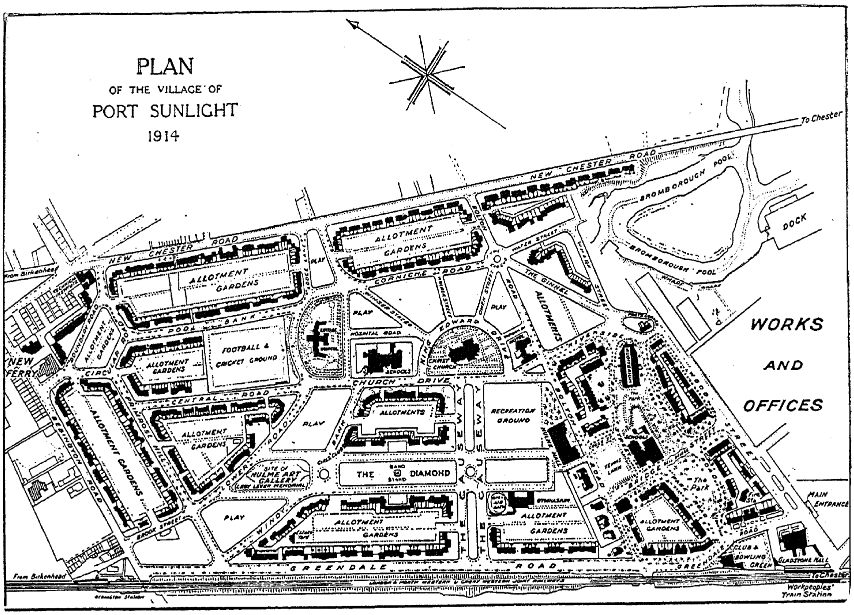


D

A. COTTAGES IN PORT SUNLIGHT. THESE WERE AWARDED THE GRAND PRIX AT THE BRUSSELS EXHIBITION 1910
Architect: W. OWEN

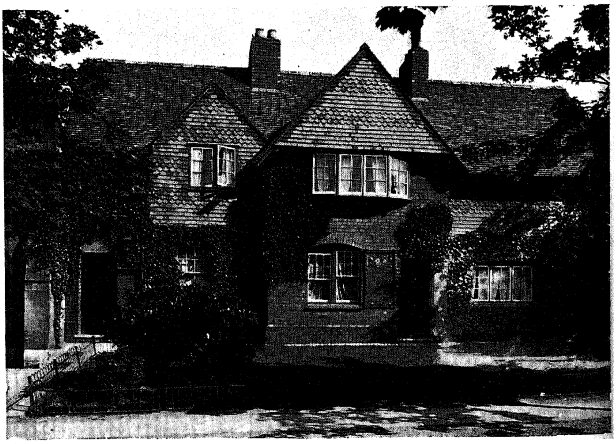
B. COTTAGES ON SEMICIRCULAR PLAN IN LOWER ROAD
Architect: C. H. REILLY

C. AN EXAMPLE OF THE 'PSEUDO HALF TIMBERING' THAT CONTRASTS WITH THE EARLIER SIMPLE TREATMENT

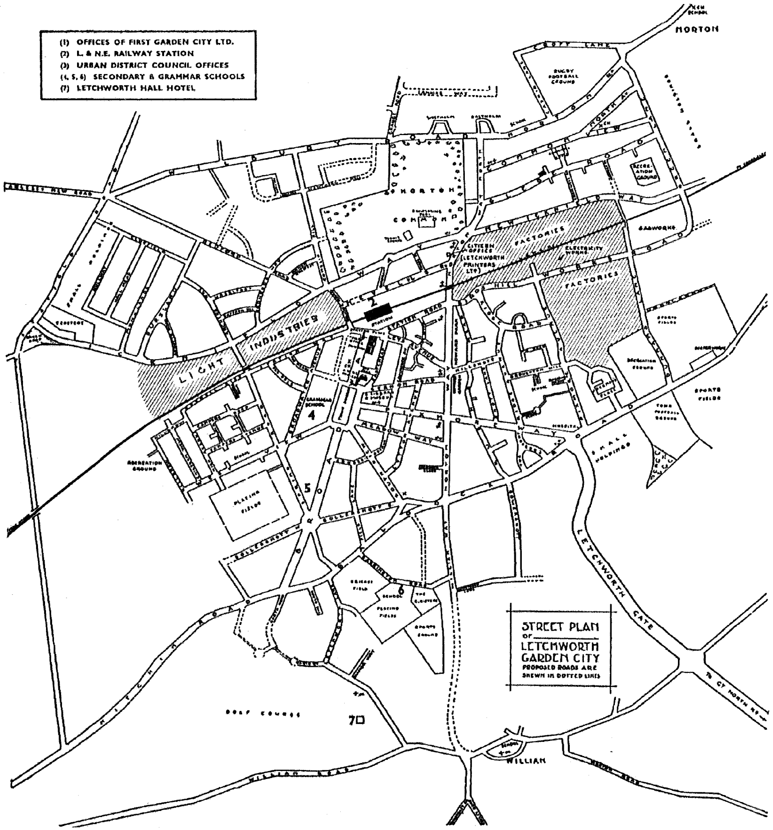
D. PLAN OF PORT SUNLIGHT AS IT WAS IN 1914

The village of Port Sunlight was founded in 1888

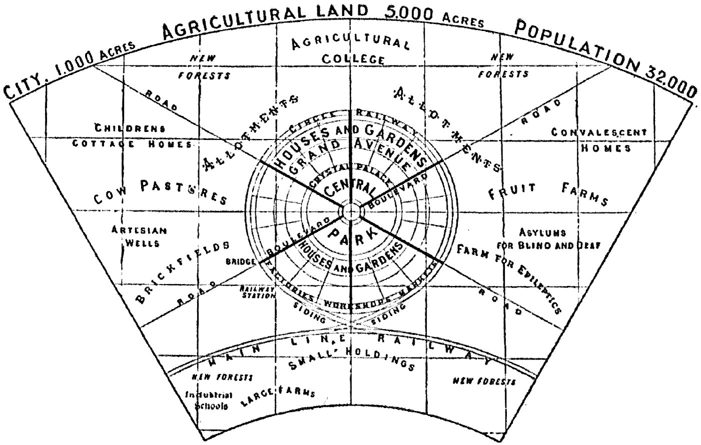
PLATE XXXIV



A


(1) OFFICES OF FIRST GARDEN CITY LTD.
(2) L. & N.E. RAILWAY STATION
(3) URBAN DISTRICT COUNCIL OFFICES
(4, 5, 6) SECONDARY & GRAMMAR SCHOOLS
(7) LETCHWORTH HALL HOTEL
NORTON
NORTON COMMON
FACTORIES
LIGHT INDUSTRIES
LETCHWORTH GATE
WILLIAN
GOLF COURSE
STREET PLAN OF LETCHWORTH GARDEN CITY
PROPOSED ROADS ARE SHEWN IN DOTTED LINES

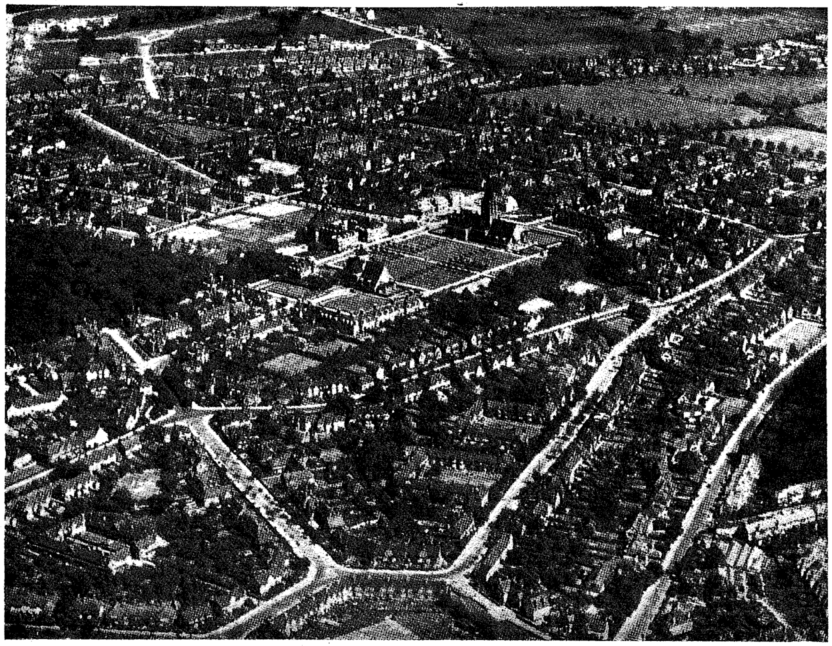
PLAN OF LETCHWORTH GARDEN CITY



A DIAGRAM OF A HYPOTHETICAL GARDEN CITY, WHICH FIRST APPEARED IN *Garden Cities of To-morrow*, BY EBENEZER HOWARD (1913)

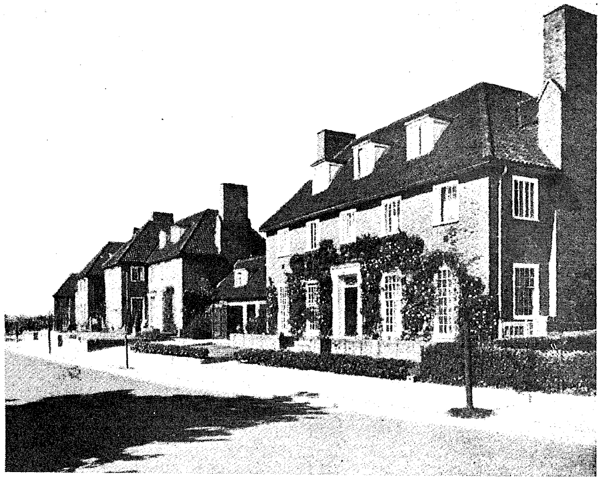
A TYPICAL HOUSE AT LETCHWORTH
Architects: BENNETT AND BIDWELL

PLATE XXXV



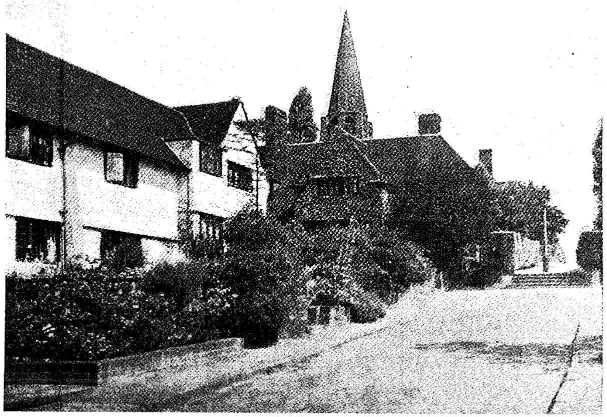
A

Photo by Aerofilms, Ltd.



B

Photo by Country Life



C

Photo by Speaight, Ltd.

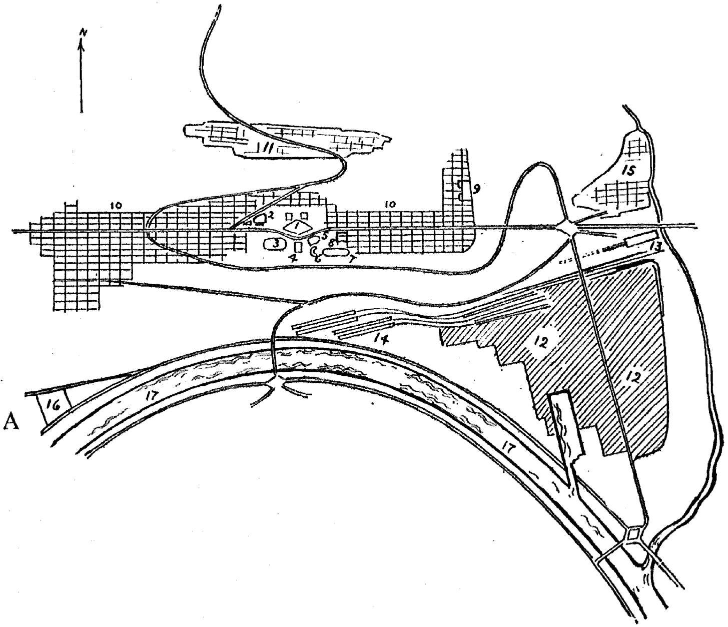
HAMPSTEAD GARDEN SUBURB WAS BEGUN IN 1906

A. GENERAL VIEW OF HAMPSTEAD GARDEN SUBURB, SHOWING THE FORMAL AND SYMMETRICAL PLANNING OF THE CENTRAL SQUARE, WITH THE MORE IRREGULAR OUTER AREAS

B. HOUSES AT THE FOOT OF BUNKER'S HILL ON WILDWOOD ROAD, ILLUSTRATING THE MORE FORMAL TYPE OF ARCHITECTURAL TREATMENT

C. HILL CLOSE—AN EXAMPLE OF PLANNING IN THE 'LANDSCAPE' OR 'ROMANTIC' MANNER

PLATE XXXVI



A

1. ASSEMBLY HALLS; 2. MUSEUMS; 3. LIBRARY; 4. EXHIBITION GALLERIES; 5. THEATRE; 6. OPEN-AIR THEATRE; 7. SPORTS GROUND; 8. SCHOOL; 9. TECHNICAL AND ART SCHOOLS; 10. RESIDENTIAL AREAS; 11. HEALTH CENTRE: HOSPITAL, SANATORIUM, ETC.; 12. INDUSTRIAL AREA; 13. STATION; 14. GOODS STATION; 15. ANCIENT TOWN; 16. SLAUGHTER HOUSE; 17. RIVER

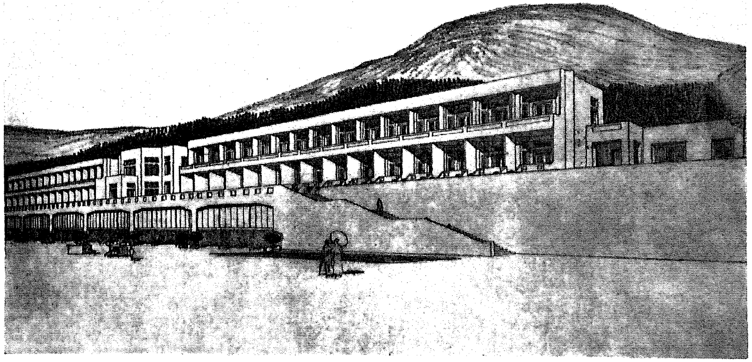
The French architect, Tony Garnier, in the early years of this century prepared a plan for an imaginary Industrial City

A. SKETCH PLAN OF THE SITE

B. A DRAWING SHOWING THE PASSAGES OR WALKS BETWEEN THE HOUSES

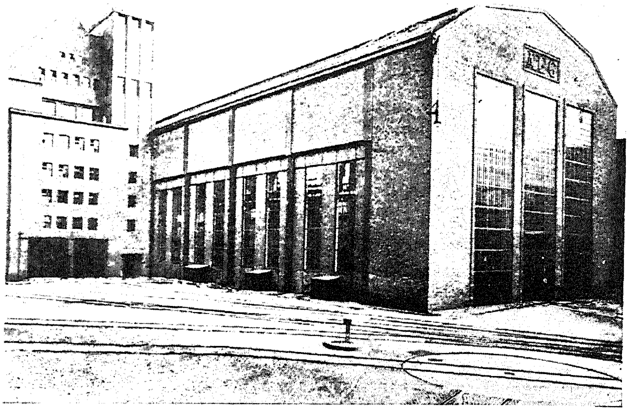
C. DESIGN FOR A SANATORIUM IN THE INDUSTRIAL CITY

B

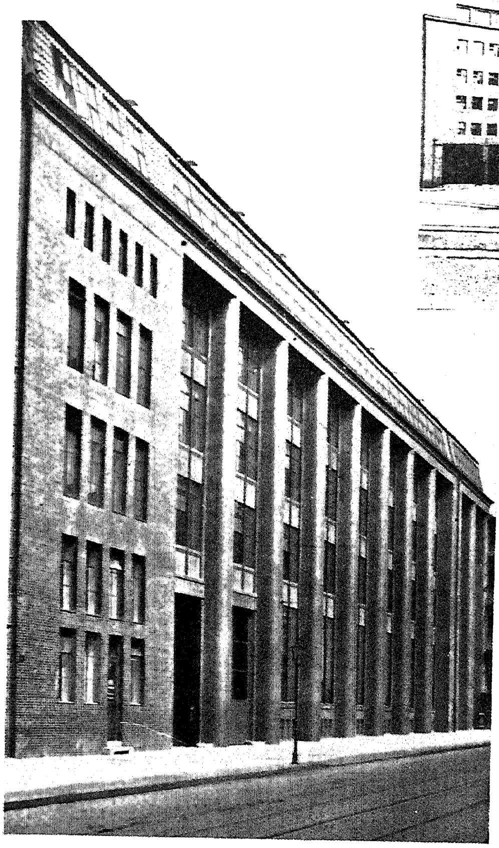


C

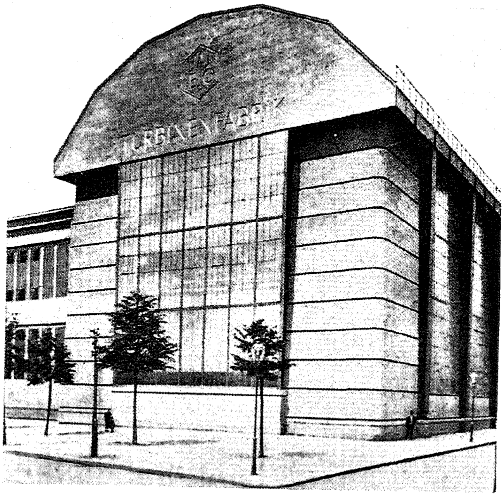
PLATE XXXVII



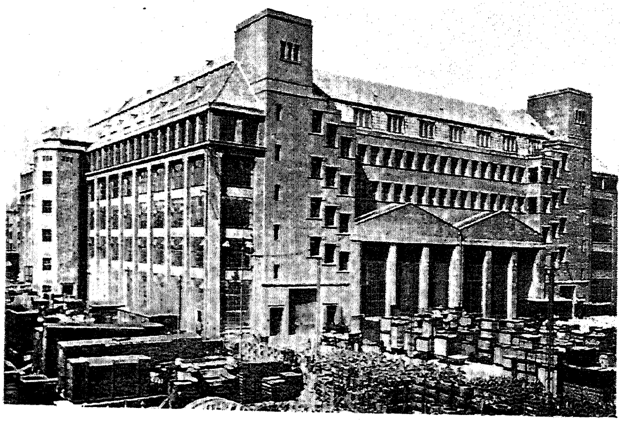
ASSEMBLY SHOP AT BERLIN (1911–12)
Architect: PETER BEHRENS



ELECTRICAL FACTORY IN BERLN (1909)
Architect: PETER BEHRENS



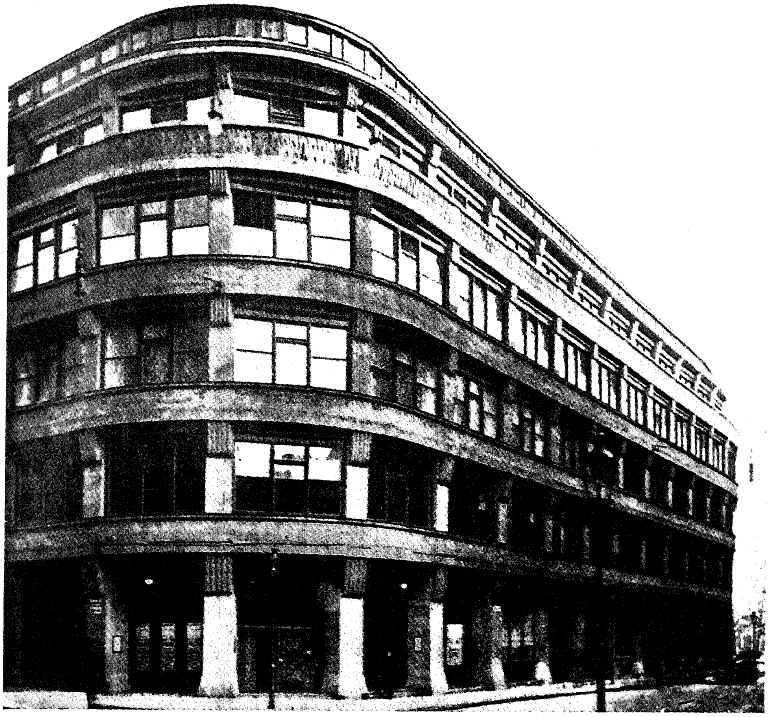
ANOTHER EXAMPLE OF BEHRENS'S WORK—THE TURBINE FACTORY IN THE HUTTENSTRASSE, BERLIN (1909)



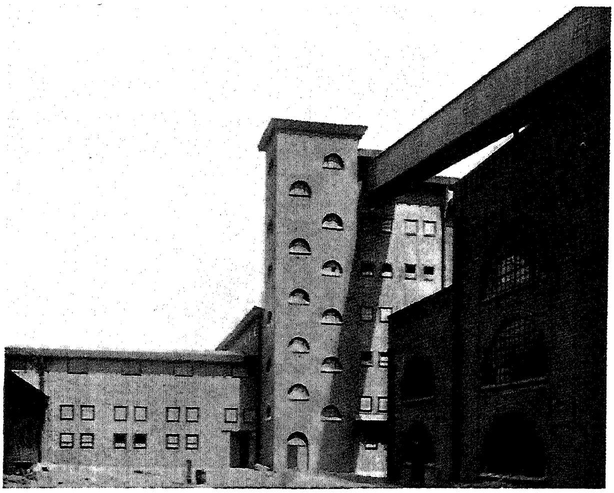
ANOTHER VIEW OF THE ELECTRICAL FACTORY

Examples of the work of
Peter Behrens

PLATE XXXVIII

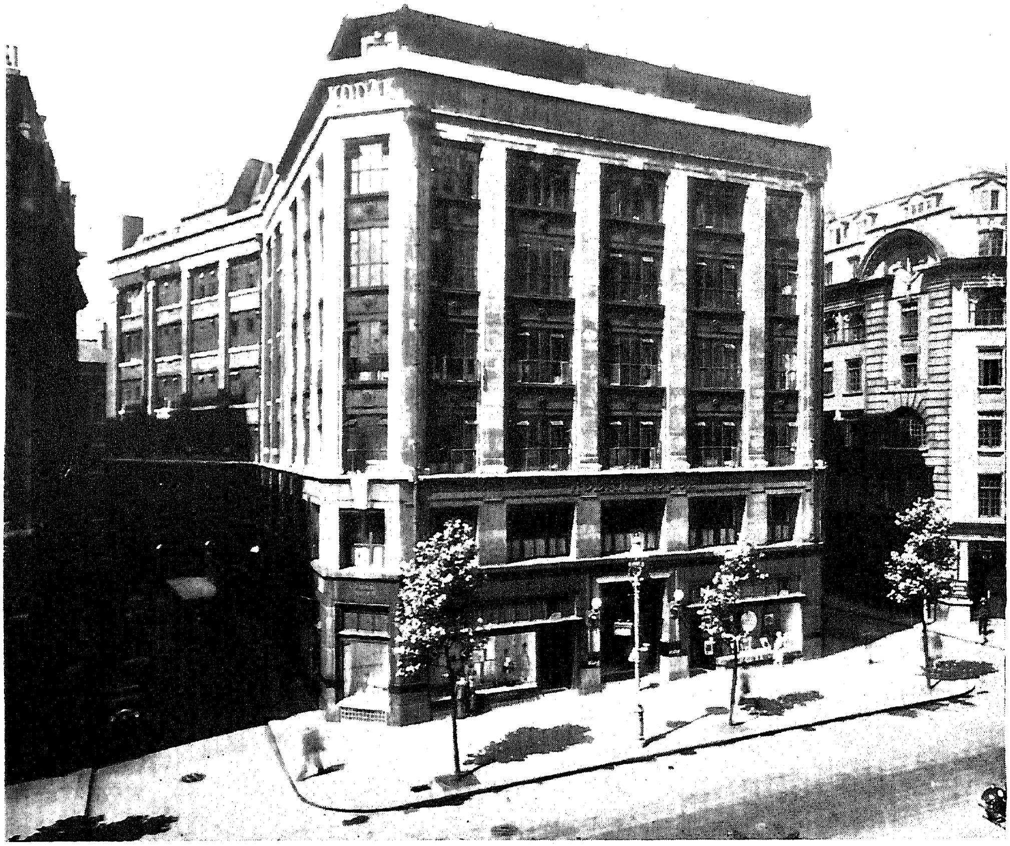


OFFICE BUILDING AT BRESLAU
(COMPLETED 1912)
Architect: HANS POELZIG



CHEMICAL FACTORY AT LUBAN (1911)
Architect: HANS POELZIG

PLATE XXXIX



KODAK HOUSE, KINGSWAY, LONDON (1911)
Architects: SIR JOHN BURNET, TAIT, AND LORNE

An early example in London of a steel frame building with elevations expressive of the method of construction. The illustration shows a sixth floor added at a later date and not included in the original design

PLATE XL

& Bidwell on Broadway, by Charles H. Spooner on Pixmore Way, and by Aylwin O. Cave on Spring Road, but there are also several where sham half-timber work is much in evidence. The house called Red Hawthorne, situated near the point where Wilbury Road joins Norton Way, is interesting for its construction. It was built in 1909 of fifteen large pre-fabricated units which compose walls, floors, stairways, and ceilings, made of rubble mixed with half-portion of cement. It was built in three days, and cost £200, although £50 was spent on transport from Liverpool, where the parts were made. Accommodation consists of a drawing-room, dining-room, and kitchen on the ground floor, and three bedrooms on the first floor. Its flat roof strikes a very modern note in Letchworth.[1]

The architecture of the centre of the town is not distinctive. The buildings of the central square have a spacious layout, and a uniform but not very interesting architectural character, but the streets of the shopping areas, although originally having a certain architectural unity, show the repetition of units of somewhat mediocre design. Since 1914 what unity existed has been in some parts destroyed and these present an inharmonious mixture as in Eastcheap, which is exceedingly unpleasant. The architectural failure of the centre of the town can hardly vitiate the social experiment, but it is regrettable. The architectural unity of the streets of Bath, the repetition of well-proportioned and dignified units, gives so much aesthetic pleasure that one is always deeply grateful for its creation. Letchworth is in a different idiom, but the principle of the satisfactory relation of parts to a whole achieved in some measure by the repetition of well-proportioned units with a variety according to differences of purpose can apply equally. If Letchworth is a brilliant success socially it is hardly that architecturally. It might be argued that it is well suited to its purpose, but beauty does not necessarily emerge from that. It has well-designed houses pleasingly set in gardens and some lovely roads, but it fails where buildings compose the more formal street effects of its central areas.

The garden city movement thus begun had a considerable influence throughout Europe, and garden city associations were formed in most European countries—in France, Germany, Austria, Belgium, Holland, Italy, Poland, Hungary, Spain.[2] Although, after England, France was the first to form such an association in 1904, it was in Germany that the movement was strongest, and many schemes were promoted there which were inspired by the movement. Those which most closely correspond in conception to the true garden city are Hellerau, near Dresden, commenced in 1908, and München-Perlach, but they are much too small for full realization of the idea. Numerous garden suburbs were developed in the early years of the century like Stockfield, near Strasbourg, an enterprise of the municipal authority; and Altona, near Hamburg, designed for a population of 30,000. Also numerous industrial estates on the lines of Bournville were developed, but no garden city of the scale and social comprehensiveness of Letchworth had really been begun elsewhere in Europe before 1914.

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[1] This house is described in *La Cité jardin*, by Georges Benoît-Levy (Paris, 1911), vol. i, p. 94.

[2] An account of this movement in Europe is given by Georges Benoît-Levy in *La Cité jardin*, vol. iii, p. 109 et seq. A briefer account is given by E. G. Culpin in *The Garden City Movement Up-to-Date* (London, 1913), p. 61 et seq.

In the interest shown in the movement, especially by municipal authorities throughout Europe, there was not a sufficiently clear understanding of the difference between a garden city and a garden suburb. A full appreciation of the social value of Howard's conception should prevent confusion with the garden suburb, which, agreeable as it may be as physical planning, is a growth that must be severely restricted if it is not to destroy by its very existence good social planning.

Some of the many garden suburbs in Germany and England commenced in the early years of the century offer good and interesting examples of domestic architecture, both of the slightly larger detached house and of the smaller houses forming units repeated in a unified whole. There are some good examples in Margaretenhohe, a garden suburb for old people near Essen, where features of German medieval domestic architecture are incorporated; and in Hellerau, where the simple units with plain white walls and sharp-pitched roofs repeat satisfactorily. It is perhaps not mere fancy to think of the influence of Voysey and Peter Behrens. But that which is architecturally the finest in the decade before the First World War is Hampstead Garden Suburb. The reason for this is that its architecture is partially a product of the tradition begun by Morris and Webb, which resulted in such excellent domestic work for the period from 1860 to about 1905, when English building in this sphere was a model and inspiration to numerous continental architects as mentioned in Chapter V. Hampstead Garden Suburb was begun in 1906. Its original 243 acres, since enlarged to 317, were planned by Sir Raymond Unwin and Barry Parker, in consultation with Sir Edwin Lutyens. The central square and immediate surroundings are formal and symmetrical, and remind one of classical and Renaissance planning, while the outer areas are more irregular and emerge from medieval planning. The two churches—St. Jude-on-the-Hill and the Free

—the Institute in the Central Square, and the houses facing it and on the approaching roads were designed by Sir Edwin Lutyens. The other houses in the suburb were designed by various architects, among them Sir Raymond Unwin and Geoffrey Lucas, and they are designed chiefly in that medievally inspired tradition so powerful at the time. The visitor to the suburb would probably be impressed by the formal centre surrounded by buildings in which Renaissance tradition is freely interpreted —stone dressings on brick buildings is a favourite theme—but in which symmetry is insistent; and by many of the winding roads of the other parts flanked by houses in which medieval picturesqueness and expressive use of materials is frequently recaptured. Lutyens is eclectic in the church of St. Jude-on-the-Hill in combining the spire and vast expanse of pitched roof with an otherwise Renaissance design, which is completely dominant in the interior.

Almost contemporary with the planning of the first garden city, Tony Garnier was working on his plan for an industrial city. He actually made the plan in outline in 1901, while the details were worked out by 1904, but it was not published until 1917.[1] He made designs for every detail, and made plans and perspective drawings of all the buildings, including a considerable variety of houses. It has many features similar to Howard's garden city. It is planned for a population of 35,000, and includes industry, housing, social and recreational amenities, cultural facilities, and, like Howard's plan, it comprehends social life as a whole. It is also a progressive contribution to architectural design. The plans and drawings represent a great achievement, and it is regrettable that so fine a design has so far existed only in imagination. Perhaps one day it will have a physical existence necessarily modified, although Garnier's work at Lyons incorporates features of it, while it has had some influence on subsequent town planning and architecture (Plate XXXVII).

The imaginary town, of which a sketch-plan is illustrated, is situated on the north bank of a river from which the ground rises gently. The residential area is roughly of a long rectangular shape, in the centre of which are the public buildings devoted to culture and recreation. There are assembly halls, museums, library, exhibition galleries, two theatres (one open air), a high school, and a sports ground. To the north higher up on the slopes is the health centre, with hospital, sanatorium, and convalescent homes, separated from the residential area by a strip of open space. To the south-east, nearer the river bank, also separated from the residential area by a strip of open space, is the industrial area connected with a goods station a little to the west.

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[1] *Étude pour la construction des villes* (Paris, 1917).

Although it is planned for a population of about 35,000 there is provision for extension of both industrial and residential areas, but Garnier does not indicate the limits of the extensions. They would take place, presumably, to the east of the industrial area, while the residential strip could be extended westwards, and northwards at its eastern extremity. But it is clear that if the town grew very much the amenities for 35,000 would be inadequate, and the distance of people's homes from the industrial area would be inconveniently increased. To the suggestion that new amenity centres and new industrial areas could be added, it must be replied that you are merely adding one town on to another and creating limitless lineal development. This has its advocates provided the strips of open space are always preserved so as to ensure close proximity of built-up areas and open spaces, but it renders difficult the satisfactory proximity of more extensive country areas which is so good a feature of the garden city.

The architecture of Garnier's Industrial City is inspiringly progressive. The whole city is built in the new medium of ferro-concrete—factories, public buildings, and houses. At the same time Garnier was an enthusiastic classicist, and the influence of his early training and successes never left him. In winning the *Prix de Rome* he satisfied judges dominated by classical ideas. In the architecture of his Industrial City, and in his executed work at Lyons, he adapted the dignity, restraint, and proportion of Greek architecture to modern requirements. The remarkable series of drawings give the impression of a city not dissimilar in character and atmosphere to the imagined cities of ancient Greece. This is especially so in the residential area. The houses are arranged in a series of five or six long plots, the outer ones only are near the roads, the others being separated by footways lined with trees. They are one- and two-story houses, and are mostly detached or semi-detached. Most of the smaller houses have a living-room, kitchen, bathroom, and two or three bedrooms. They are orientated with due regard to the sun, they all have flat roofs, there is little ornament, and they depend for architectural effect on the balance of horizontals and verticals and relations of openings to wall spaces. Many of the other buildings, like the railway-station, the museums, exhibition galleries, and schools, show an interesting use of reinforced concrete, with a sense of its constructional possibilities, but designed always with a strong Greek flavour.

It is outside the scope of this work to discuss town planning as a physical pattern of built-up areas in general. It is my purpose to consider evolution in town planning as it affects architectural development; but it is difficult often to limit consideration of their relations as the two subjects constantly overlap. Town planning is so often, as Garnier's Industrial City shows, the general design of which architecture is a detail. Yet some limit must be imposed, and that limit should be according to the degree of its pertinence to the social basis of architecture. I have already said that where architectural effect depends on the repetition of a unit like the small house, town planning must be considered, for it is precisely here that architecture is closest to social needs, for family life is the starting-point of all social development. Even if architecture is much more than the satisfaction of social needs, it must be remembered that it has its roots in them, and if the roots are not well planted and the soil well nurtured the flowers of architecture may be very poor.

CHAPTER XV

The Foundations of a New Architecture

AN architecture that emerges logically from economic and social needs, and from technical development, and which in its forms is expressive of contemporary life, was beginning to be established during the few years before the First World War. We can remember how Schinkel sighed for a living contemporary architecture. To repeat his words already quoted: 'All great ages have left a record of themselves in their style of building. Why should we not try to find a style for ourselves?' In the few years before the war, Europe, for the first time since the fifteenth century, was beginning to leave a record of itself in building which was the independent outcome of its stage of technical and social evolution, and thus the twentieth century was beginning to evolve an architecture expressive of its own life, dependent on the past only in the sense that experience equips an artist and technician to solve the problems of his own day.

In the preceding chapters we have traced the principal developments that led to the new architecture.[1] Firstly, we have seen the striving of Labrouste, and of Morris, Webb, and their followers that 'Architectural form should be appropriate to the function for which it is intended', to quote the words of Labrouste; secondly, we have seen in the striving for a living style the creations of *L'Art Nouveau* which, though not fundamental, probably had an invigorating effect on thought about the principles of design; thirdly, we noted the movement towards simplicity, which played its part in the search for a style by the rather negative process of eliminating ornamental dressings taken from the past; fourthly, we noticed the work of engineers in their use of new materials of iron and later steel and concrete, and the new methods of building these brought into being with their greater structural possibilities; and fifthly, we considered essential social needs in relation to building. With the exception of the second, these factors are necessary for the creation of a living architecture. It is, however, principally the appropriateness of form to function, the sloughing of the ornament of past styles, and the use of materials with greater structural potentialities that provide the basis of modern building which is essentially of its age. But something more is required of a living architecture. For we are concerned with architecture as an art, which is not merely good, efficient structure suited to its purpose, but building which is expressive and beautiful.[1] Building should, therefore, be expressive of its function and expressive of its structure. It should also give a feeling of unity, which is a prime requisite of beauty, in which the parts are satisfactorily related to a whole. The fulfilment of these conditions is necessary if a full degree of aesthetic appreciation is to be aroused.

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[1] I use the term 'new architecture' as it is the term used by its principal exponents.

I mentioned in Chapter V that Schinkel might have seen the basis of a living style in the factories and warehouses in the north of England that he visited. And it is mainly in industrial buildings that we find the first and most vigorous expression of the new architecture. In such buildings a primary concern is with utility, efficient design for purpose being an industrial asset and a more important consideration than appearance, while the employment of methods and materials with greater structural possibilities, offering greater speed, economy, and efficiency in building are of paramount importance to the industrialist. Thus we find that of the early steel-framed and ferro-concrete buildings a very large proportion are of an industrial character, like warehouses and factories. The majority of office and public buildings, erected before 1914, in which new materials and methods of construction are employed, have very much the appearance of stone or brick buildings in a traditional style. The Royal Liver building at Liverpool, completed in 1910, and designed by W. Aubrey Thomas, was constructed of a ferro-concrete framework, but is stylistically a mixture of Romanesque, Byzantine, and Renaissance, into which, however, a slightly modern character is infused in the massive façades due to a tentative and slight expression of the structural framework.

We have noted that English domestic architecture from 1860 to 1905, as represented by the work of Webb, Shaw, Voysey, and their followers, was the most important in Europe and exerted a wide influence. It represented an important contribution to the realization of a living and expressive architecture. After 1905 the progressive development continued mainly in Austria, Germany, and France. Much good work in domestic architecture was done in England between 1905 and 1915 by many architects following Webb, Shaw, and Voysey, mentioned in Chapter V, examples of which are seen in Hampstead Garden Suburb considered in the last chapter; but they merely continued the good work of the forty previous years: they did not develop or add anything to it. They did not study the possible use of new materials like steel and concrete, or new methods of building. And in some of the works, such as the less satisfactory examples of Baillie Scott and Guy Dawber, there is a tendency towards sentimentality in efforts to recapture medieval character and atmosphere.

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[1] It is impossible here to digress with a discussion about the philosophy of art. I shall have occasion later to consider what constitutes the basis of the aesthetic appreciation of architecture. For the present it must be necessary to accept art broadly as the expression of life and the creation of beauty. Whatever else it may be, it would be difficult to deny convincingly that art is based on these two fundamentals.

In Germany, on the contrary, architects take the point at which these architects of England had arrived about 1905 as one from which to develop farther. In saying that the main developments from 1905 to 1915 took place in Germany, Austria, and France, I do not suggest there were no progressive examples in other European countries. A certain number are found in Italy, Poland, Hungary, and more particularly in the northern European countries, such as Holland, Denmark, Sweden, and Britain. They are the work of isolated individuals rather than work emanating from groups with unified convictions. Some of these isolated examples in Britain are noteworthy. Lion Chambers, Glasgow, designed by Salmon, Son & Gillespie about 1908, although well behind Perrett's work a few years earlier, does partially express its ferro-concrete frame construction, mixed a little with traditional stylistic features. More impressive are some of the examples collected by Nikolaus Pevsner and dealt with in an article in the *Architectural Review*, with the suggestive title of 'Nine Swallows—No Summer'.[1] He actually cites more than nine, but probably thinks that only nine may really be regarded as pioneer examples of the new architecture. Many other examples, however, could be added to the industrial buildings in ferro-concrete that he mentions, some of which were referred to in Chapter XI. A large number of such factories have gridiron façades, due to the pattern of the concrete frame. Pevsner mentions some interesting houses, one being a simple flat-roofed house of brick, built in Stafford in 1908 by Edgar Wood. He also mentions a flat-roofed block of offices, built by J. Henry Sellers, also in 1908. Both these buildings have large plain walls and large simple windows pleasingly spaced.

The most modern buildings erected in London before the First World War were Sir John Burnet's famous Kodak building in Kingsway (Plate XL), built in 1911, and the Stationery Office warehouse, built two years later by Sir R. J. Allison. In the former building the site is somewhat awkward, and there is an attempt to adapt a symmetrical plan to it, but the steel frame of which the building is constructed partially determines the design of the façades. Above the second floor the effect is of large glazed areas and bronze panels between stone-faced uprights, conveying faint reminiscences of Renaissance pilasters. The Stationery Office warehouse is constructed of reinforced concrete and expresses its frame in its gridiron façades.

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[1] *Architectural Review*, vol. xci, pp. 109–12, May 1942.

Peter Behrens, more progressive than his English contemporaries, follows English domestic work up to 1905 and then develops further, as we have noted in Chapter IV. But it is in his industrial buildings that we find the greatest progress and the greatest use of the new methods and materials. Behrens became architect of the A.E.G. (General Electric Company of Berlin), and the buildings he designed for this company represent some of the most impressive examples of the new architecture before 1914, some of which are illustrated (Plate XXXVIII). In these industrial buildings of Behrens full use is made of the pioneer work of engineers. This is seen especially in the spanning of big spaces with steel and glass roofs, as in the Turbine factory and other shops where large machinery is employed. It was in 1909 that he built the immense Turbine factory in the Huttenstrasse, Berlin (Plate XXXVIII). It is constructed of a steel frame, which is strongly apparent in the appearance of the building. The top of the end wall denotes the shape of the steel and glass roof. There is grandeur in the steel uprights with large spaces of glass between, and broad corner masses. It is industrial architecture at its best. In the Assembly Shop, built 1911–12 (Plate XXXVIII), there is a similarity of shape to the Turbine factory but not quite the same sense of grandeur is achieved. The side façades, for example, being broken up more, have not the impressively long lines and large masses. But generally in most of Behrens's industrial work of this period the building expresses its steel skeleton and the general effect is massive and simple, and sometimes with that touch of grandeur notable in the Turbine factory.

Contemporary with these industrial buildings of Peter Behrens are some interesting contributions to the new architecture by Hans Poelzig. The work of Poelzig is always original, and often daring. He seems always to regard architecture as an exciting adventure. In 1911 he built a chemical factory at Luban (Plate XXXIX). The forms clearly express its brick structure. The large number of small windows was probably one of the requirements of the factory, but it is difficult to think how the small circular-headed windows are functionally satisfactory.

These windows are apparently a decorative device that appealed to Poelzig, as he introduced them to an even greater extent in a design for a water-mill made in 1910.[1] In this water-mill are two blocks connected by

[1] Reproduced in Bruno Taut's *Modern Architecture* (London, 1929), p. 61.

a bridge over a lock, and on the walls facing each other are projecting glass and steel structures, which represent a more modern note than the remainder. But more important than either of these is the Office Building at Breslau, completed in 1912 (Plate XXXIX). Here the steel-framed structure is clothed fairly massively, but the frame controls the design, while glass occupies almost wholly the intervening spaces. And here, for the first time, we have the horizontal emphasis in the façade, introduced by long, unbroken bands at each floor-level. This was to become later a favourite motif, first in German office and store buildings, then in buildings of all types throughout Europe.

In the developments of the new architecture it is possible to trace two distinct streams, and two main schools of thought. It is convenient to think of them as medieval and classical. It is true that architects who belong to the former are not conscious of medieval tradition, and that the bulk of their work may be industrial and determined largely by industrial requirements and the pioneer work of engineers. It is rather a habit of thought. One can imagine that if a typical medieval architect had to design a modern factory he would have designed it very much as does an unrestricted exponent of the new architecture. He would consider the most convenient plan, the best way of building to satisfy purpose most efficiently, and he would certainly have employed the most recent materials and methods of construction. The point is he would not have been troubled by any beliefs that building should conform to any laws other than those determined by its purpose and efficient construction. One may say, broadly, that the progressive architects of England, Germany, Holland, Sweden, and Denmark are of this school. But the architect in the classical tradition has so often a sense of the divinity of geometric law, and a belief that building, if it is to be of architectural value, must conform to geometric law. We have already discussed this in some detail in Chapter VI. The question it is important to ask in reflecting on this phase of modern architectural development is: does this belief in the divinity of geometric or mathematical law, which seems to have been a belief of many of the ancient Greeks, as of some modern mathematicians, handicap architects in the full development towards a living architecture? I think it does. This phase began in Austria with the doctrines of Otto Wagner, and its influence is apparent in the work of Adolf Loos, as before noted, and in that of Tony Garnier, and later in the work of Le Corbusier and those influenced by him. It would seem, then, that it is in Austria and France that this phase finds its chief expression.

There is a suggestion of this difference between medieval and classical influence in the work of Poelzig and Behrens. The massive proportions and monumental grandeur of many of Behrens's industrial buildings suggest the influence of classical tradition, while his German Embassy at St. Petersburg (Leningrad) is essentially a classical conception; whereas the work of Poelzig has a romantic and less formal quality suggestive of medieval tradition. But it is not so much in grandeur of character that the classical strain is most potent in the new architecture. It is rather, as before insisted, the divinity of mathematical law and geometric forms, the authority of Plato in the *Philebus* when he claims absolute beauty for 'straight lines and curves and the surfaces or solid forms produced out of these by lathes and rulers and squares', which is the most potent influence in what I call the classical strain in the new architecture as distinct from the freer developments which are not circumscribed by such authority. Although Behrens is undoubtedly influenced by effects of classical grandeur, he is in no sense restrained by the aesthetic divinity of geometric form and classical proportion.

In their use of the new materials like steel and concrete, and consequently new methods, architects like Wagner and Garnier are restrained by the classical tradition. It is in roofs demanding steel and glass, where the classical tradition can hardly be so insistent, that we find the greatest freedom. Yet with Wagner the schematic welding of such features with classical character is done with consummate artistry. The steel and glass roof of the Post Office Savings Bank in Vienna, built in 1904–6 (Plate XLI), is of an elliptical shape, but is welded with complete harmony to the restrained square-like character of the remainder of the building. Tony Garnier, in the Cattle Market and Abattoirs at Lyons built in 1913–14, covers the vast market hall, with a steel roof of 262 feet span, with slanting box girders (Plate XLI), but he makes the exterior shape flat, with step effect. In the covered street the roof is of flat, boxed steel girders.

Garnier chooses ferro-concrete as his favourite medium because in this, rather than in steel and glass construction, he can express his classical feeling more strongly. It will be remembered that his Industrial City is all conceived in reinforced concrete, and classical forms dominate the conception of most of the houses and some of the other buildings, although here and there, as in the railway station, he adventures with the potentialities of the new medium. In the Cattle Market, in the Hôpital de Grange Blanche (1911–12), and in the School of Arts, completed in 1917, all at Lyons, the dependence for effect on the balance of horizontals and verticals, and the relation of window openings to wall spaces, are all conceived with the classical tradition as the all-important background. In the School of

Arts the magnificent entrance is adorned with large architectural fragments—part of a Doric temple and an Egyptian column, while Ionic and Corinthian capitals appear on pedestals at the foot of the staircase. Garnier must have been happy designing the Sports Stadium at Lyons, completed in 1910 (Plate XLI). Although Greece and Rome were obviously much in mind when he designed it, ferro-concrete is used expressively so that he achieves long, unbroken sweeps, and a fine Doric austerity. It is thus obvious that ferro-concrete had an appeal for Garnier because it is a reinforced synthetic stone capable of design in the same spirit as Greek architecture. But it is when his background of classical architecture becomes dim, and he ventures with his material, as in the railway station and in the hospital and sanitorium of the Industrial City, that he makes the most valuable contribution to architectural and constructional development.

The work of Auguste Perret, the other great French pioneer in the new architecture, has already been dealt with in Chapter XI. We noted how his house at 22 Rue Franklin, his garage in Rue de Ponthieu, Paris, and his Champs-Élysées theatre are, in their architectural forms, expressive of the structure he employs. The two former, although earlier by several years than the Champs-Élysées theatre, are much freer expressions, as the theatre is more strongly influenced in conception by classical forms. The design of the garage in the Rue de Ponthieu, where glass occupies most of the spaces in the concrete framework, is the most free expression of structure and purpose, but even here the symmetry and nice relation of horizontals and verticals in the façade suggest that classical dignity is not forgotten.

The architect who, before 1914, advanced most decisively and with the completest freedom to building that is the logical outcome of a full use of technical and industrial developments employed in design emanating from the best fulfilment of function is Walter Gropius. The cradle of so many of the great architects of the period between the wars was the *atelier* of Peter Behrens. Walter Gropius worked there from 1908 to 1910, and among other assistants and students at various times were Mïes van der Rohe, Le Corbusier, who, however, was there rebelliously only for five months, Steinder, Johannes Schreiner, and many others. Gropius was impatient to start on his own, and his first work was the Fagus shoe-lace factory at Alfred-an-der-Leine, built in 1911 in collaboration with Adolf Meyer (Plate XLII).

In this factory the potentialities of steel and glass are realized as fully as ever before. The structure is a steel frame supporting floors, and the walls have become just glass screens fixed to the frame. As if to emphasize the non-structural screen-like character of the glass walls, and their dependence on the frame, there are no structural uprights at the corners, but the glass screens continue uninterruptedly. These transparent walls partially negate the distinction between inner and outer space, and give the workers within the feeling, as far as light is concerned, of working in the broad daylight out of doors, yet protected from rain and cold.

Gropius designed buildings for the Deutsche Werkbund Exhibition at Cologne in 1914, the Administrative Office Building being the most important. This building is symmetrical with central entrance; the central portion of the front part of the building is faced with brick, but spiral staircases at the wings are enclosed entirely by glass, which continues at the sides and on the first floor for the whole length of the rear of the building. The steel frame holding these glass screens is reduced almost to an efficient minimum of bulk, and never before had a structure given so completely an impression of lightness. The weather-protecting elements separating the interior from the 'open air' have become light and intangible. In the glass towers enclosing spiral staircases we have for the first time what was to become so distinguishing a feature of many later buildings, particularly departmental stores. This building had a flat roof that could be used for dancing, and which was appropriately covered. At the back of the building were a hall of machinery and open garages, also designed by Gropius in collaboration with Meyer. The hall of machinery had a slightly pitched roof, the steel frame curving from the walls, which were largely glass between the stanchions. All these buildings were destroyed during the First World War.

At this Deutsche Werkbund Exhibition were buildings by other architects like Peter Behrens, Josef Hoffmann, Van de Velde, and Bruno Taut, showing the progressive spirit of the new architecture, although not quite so convincingly and decisively as in Gropius's work. One interesting structure from the standpoint of the use of glass was Bruno Taut's glass house, which consisted of a twelve-sided drum on which was a pointed dome, all of glass, enclosing a circular staircase. Taut had already been responsible for a sixteen-sided steel-framed water-tower at Posen (1910) and an octagonal steel-framed exhibition building at Leipzig (1913). All are similar in conception, belonging clearly to the same family of ugly growths.[1]

At this point it is useful to recapitulate briefly some of the more conspicuous features of the new architecture that appear as the result of technical development. There is the frame structure, either of steel joists or reinforced concrete, with greatly increased spans where desired with non-structural screens between, which can be transparent or opaque, so that it is possible to erect wide-spanned transparent structures beyond the powers of previous ages; cantilevering which renders possible considerable structural projection without support; the reduction of bulk so that the width of walls at the base of a high building need only be a small proportion of what they would be if constructed of stone or brick; the flat roof which gives greater freedom in planning and which renders additions to the structure much simpler;[1] and the element of standardization and mass production made possible by steel because large sections can be made in factories and can be assembled speedily in all weathers.

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[1] They are illustrated in Bruno Taut's *Modern Architecture* (London, 1929), pp. 55, 56, 59, and 60. They are not of sufficient architectural merit to illustrate here.

We have noted the strivings of various architects towards a living architecture which culminated in the establishment of the new architecture in the few years before 1914. The architects who did most in the later phases of this movement, that is, roughly in the early years of the twentieth century, were Otto Wagner, Adolf Loos, Auguste Perret, Tony Garnier, Henri van de Velde, H. P. Berlage, Heinrich Tessenow, Peter Behrens, Hans Poelzig, Adolf Meyer, and Walter Gropius. The new architecture thus established is a true living architecture because it arises from the needs of the time, because in the best examples the most satisfactory fulfilment of purpose determines design, because technical advances in construction made possible by the use of materials like steel and concrete are utilized according to their capacities, and because architectural expression and beauty emerge from purpose and structure. These are the fundamentals of the new architecture, and it more completely realizes the requirements of a living architecture than any other contemporary work. But it would be a mistake to say that it is the only living architecture that had been achieved in the early years of the twentieth century. There are degrees of a living architecture. The new architecture represents the most complete degree. A building, whatever the nature of its structure, which is merely dressed in past styles, and which is planned in accordance with its stylistic elevations, is the complete negation of a living architecture. But there are many buildings which are between these two extremes. A building may be the product of a traditional style, and it may depend mainly for its character on that style, yet modern structure modifies it to a degree so that it becomes a blending of a past style and expression of modern structure; it is thus, to a degree, living architecture. If also the plan begins with purpose rather than conformity to a stylistic elevation, then it is to a further degree living architecture. There are a large number of buildings in Europe, erected between 1900 and 1914, that belong to these categories, and they were increasing in number every year, beginning mainly as industrial buildings and manifesting later in buildings of all types.

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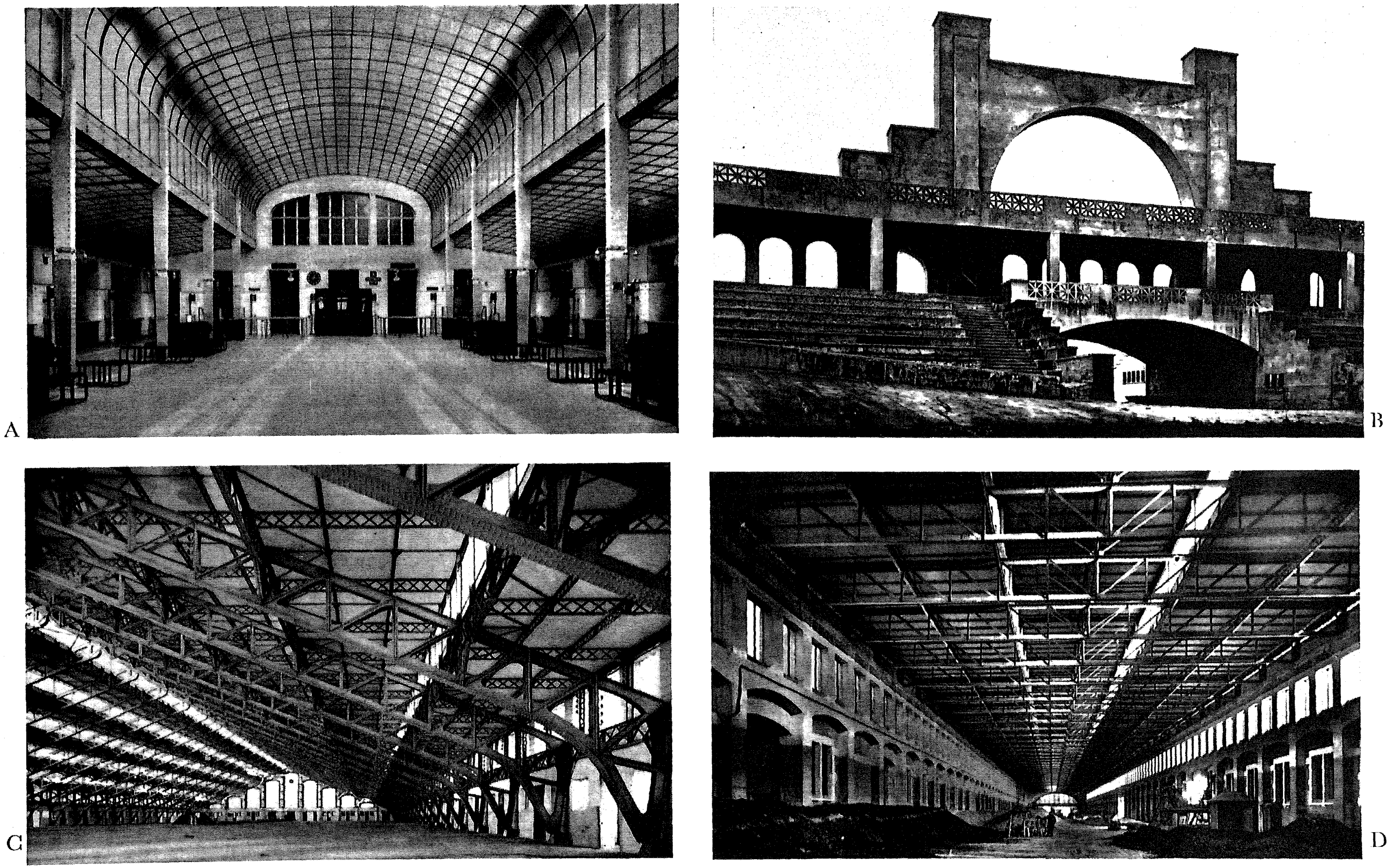
[1] Six important advantages of the flat roof over the 'old penthouse roof with its tiled or slated gables' are given by Walter Gropius in his book *The New Architecture and the Bauhaus* (London, 1936), p. 23.

If a building is an original creation because it is a fresh interpretation or adaptation of traditional styles, or if it is an eclectic blending of traditional styles, then it may be a living architecture in a different sense. The supreme example of this is Liverpool Cathedral, which is an eclectic blending of classical and medieval forms, and as modern human culture is to a very great extent a blending of Greek and Christian thought and influence, this Cathedral is clearly an expression of living culture. As we shall see later, ecclesiastical architecture, because it has to satisfy such very different requirements from industrial architecture, can live in a very different way. Liverpool Cathedral leads on to many later churches which are very much products of contemporary life, although, as can hardly be expected, when their purpose is borne in mind, they rarely achieve that more exclusive expression of our own life conspicuous in the new architecture.

That leads naturally to the importance of purpose in all building. The purpose of an industrial building is very much the product of our own industrial era, whereas the purpose of a church is the product of a spiritual life covering the period of Christianity. Other buildings lie between these. Whatever we may say about the development of construction in determining the forms of a building, it is, after all, the purpose the building has to serve which is the most important consideration of all. An architect may be technically equipped, he may be an artist, but unless he can plan so that the purpose of the building is well served by his design, he can never be completely successful as an architect. And before he can design so that a building can serve its purpose well he must understand that purpose. If it is a factory he must know the process of manufacture within that factory; if a house he must know family needs, requirements, and habits; if a school he must have some notion of the aims and methods of modern education; if an office block he must know how the work of a modern office is conducted; if a hospital he must have some notion of progress in medical science and the physical requirements of medicine and surgery; if a cinema or theatre he must know their different requirements. He must be a sociologist, a technician, and an artist. Without being all three he can never be a competent architect.

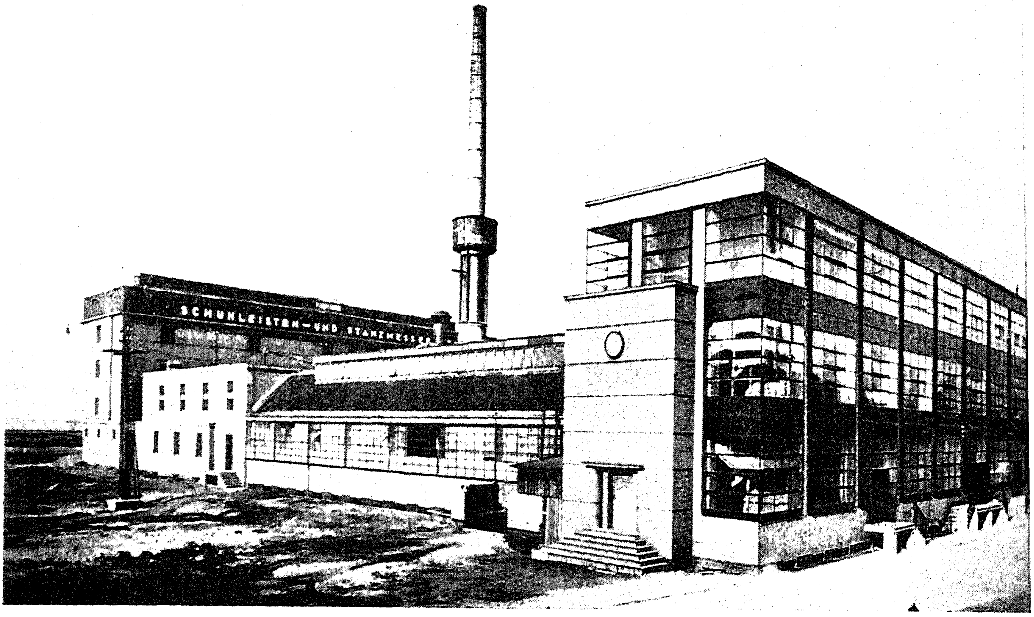
It may be objected that clients can inform the architect of the requirements of a building. But unless he knows how the purpose of various types of building can best be served by design as a result of knowledge of their requirements, he will not very intelligently interpret specific and individual requirements for any type. Insufficiency of such knowledge will reduce his powers as a creator.

The manifold purposes of modern buildings lead necessarily to specialism among architects, and we will see that, in the period between the wars, there is an increasing tendency towards specialism. This has its dangers. We will also see that the best architects specialize least. After all, variety gives greater scope for the technician and artist, and the sociologist should be able to comprehend all the essential purposes of modern buildings. In those who contributed chiefly to establishing the new architecture from Labrouste, Morris, and Voysey to Garnier, Behrens, and Gropius there is a social breadth of view which distinguishes them from most contemporary architects. And it is precisely this closer contact between the realities of social life and building that has been the chief cause in the liberation of architecture from the tyranny of past styles, and in which there is the strongest guarantee of a vigorous life in the future. It is the social, technical, and aesthetic developments of this living architecture which will form the principal material of study in the period between the World Wars.

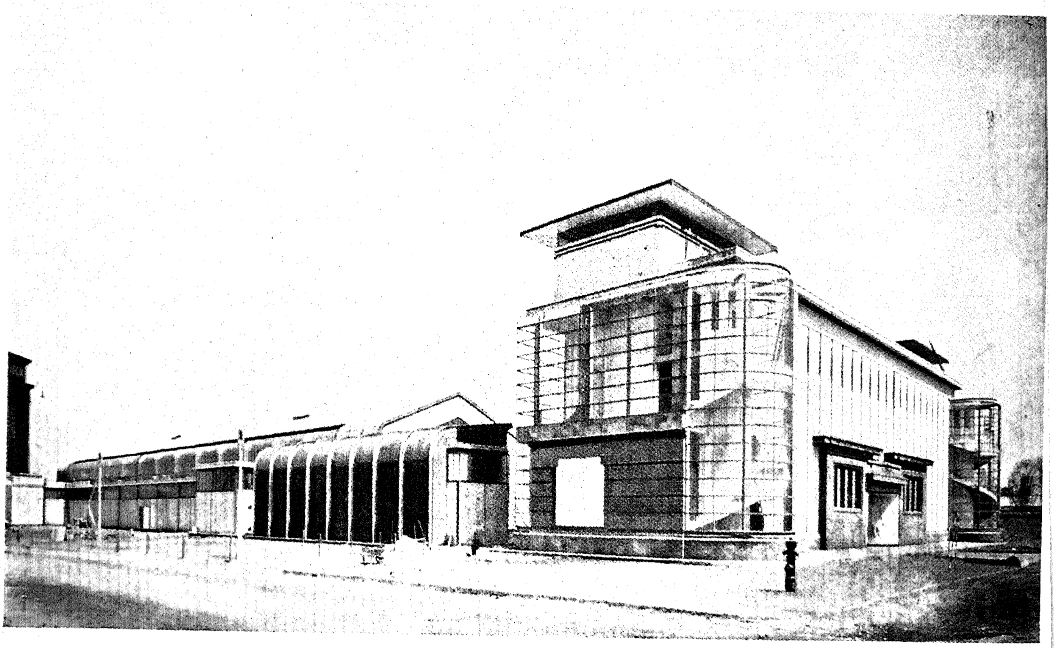


A. INTERIOR OF THE POST OFFICE SAVING BANK, VIENNA (1904–6). *Architect*: OTTO WAGNER. B. THE SPORTS STADIUM AT LYONS (1910). *Architect*: TONY GARNIER. C. MARKET HALL OF CATTLE MARKET AND ABATTOIRS, LYONS (1913). *Architect*: TONY GARNIER. D. COVERED STREET AT CATTLE MARKET, LYONS (1913)

PLATE XLI

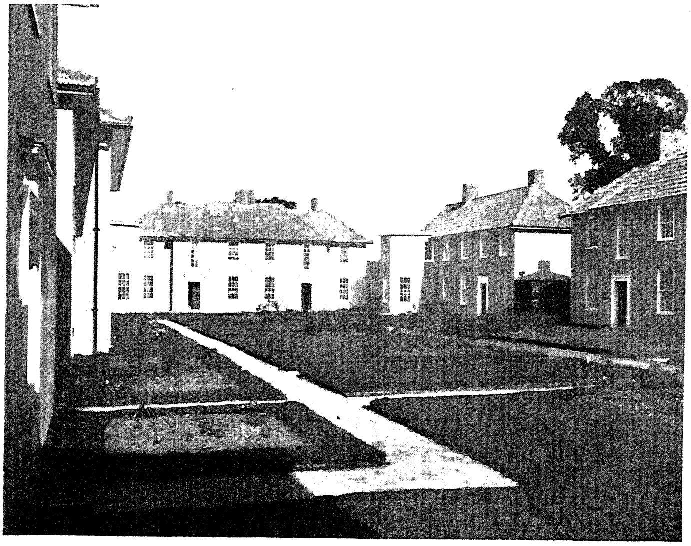


FAGUS SHOE-LACE FACTORY AT ALFREDEN-DER-LEINE (1911)
Architects: WALTER GROPIUS AND ADOLF MEYER



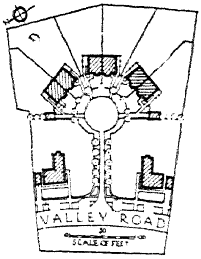
THE ADMINISTRATIVE OFFICE BUILDING FOR THE DEUTSCHE WERKBUND EXHIBITION, COLOGNE (1914)
Architect: WALTER GROPIUS

PLATE XLII

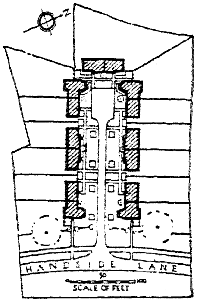


HANDSIDE CLOSE

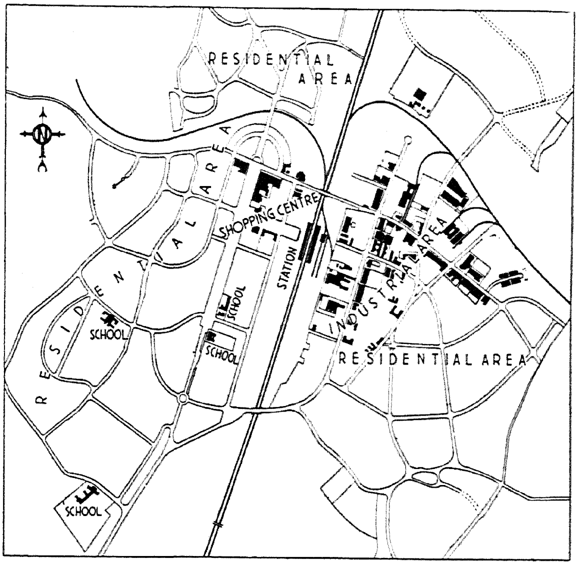
Various treatments of culs-de-sac



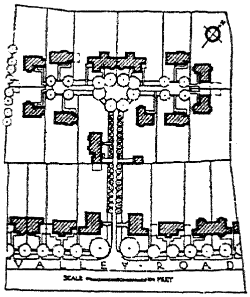
A SMALL CUL-DE-SAC WITH AN OPEN EFFECT



CLOSED QUADRANGLE TREATMENT OF PAIRS OF HOUSES WITH OPEN TREATMENT IN FRONT



GENERAL PLAN OF WELWYN

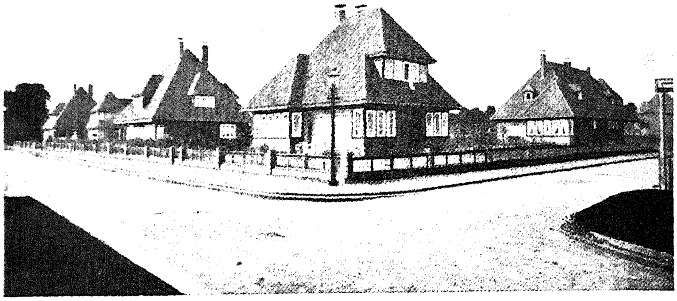


A T-SHAPED CUL-DE-SAC ON LAND HIGHER THAN THE ROAD, IN WHICH A CERTAIN PICTURESQUE EFFECT IS THE AIM

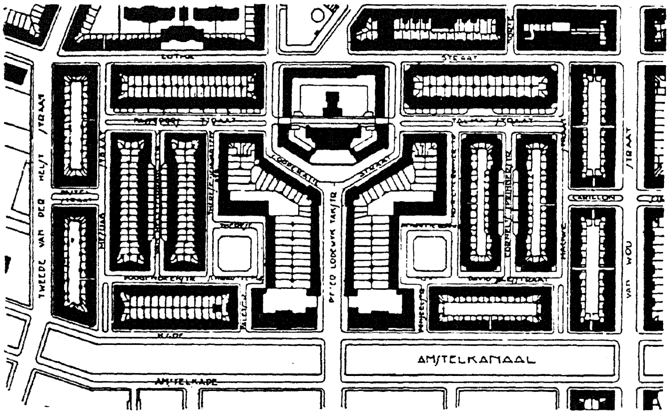
WELWYN GARDEN CITY, WHICH WAS PLANNED BY LOUIS DE SOISSONS

PLATE XLIII

VIEW OF HOUSES IN ALTONA NEAR HAMBOURG
Architect: PETER BEHRENS (1920)



PART OF THE SOUTHERN EXTENSION OF AMSTERDAM
Planner: H. P. BERLAGE (c. 1915)



PLAN OF BUIKSLOTERHAM, NORTH OF AMSTERDAM (c. 1921)

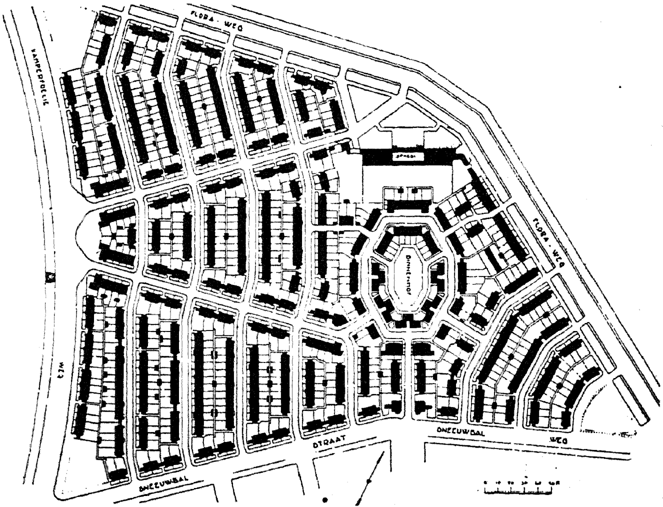


PLATE XLIV

PART II

TRANSITION FROM WAR TO PEACE, 1919–24

CHAPTER XVI

Introductory—Political, Social, and Economic Background

IN considering European architecture in the twenty years between the wars it is well to be conscious of political, social, and economic conditions, as these had considerable effect on the character of the arts in each country. It has often been argued that the arts are most progressive and flourish best where there is a fair measure of democratic freedom, or under a liberal and cultured administration. Any government which savours of intellectual tyranny or greatly restricts freedom of thought, that seeks to impose the will of the state on the individual and confine his thought to that will, any government which seeks to determine the character of artistic expression and thus curb its freedom is deadening to the arts. The period in Europe between the wars offers examples of this. Often in the political and social character of a state we will find one explanation of the nature of architectural expression, and we will find that in one or two states this varies as the political system changes. It is convenient, therefore, to divide the study into the three stages into which the period seems naturally to fall: the period of transition from war to peace from 1919 to 1924, the period of hope and progress followed by economic depression from 1924 to 1933, and the ensuing political and social unrest from 1933 to 1939 which ended with the Second World War.

The principle that was to govern the map of Europe following the peace treaties was the geographical distribution of races, which was tantamount to self-determination of the peoples concerned, a principle so strenuously advocated by President Wilson. Although its application was good in some cases, it presented difficulties in others. These difficulties were aggravated by the existence in certain cases of secret treaties which often took the form of bribes in the form of territory to induce certain European countries to join the cause of the Allies. (The promise of Transylvania to Romania and of the Trentino to Italy to induce these countries to join the Allies are two examples.) Of the three principal countries at the Peace Conferences, France alone was part of the mainland of Europe, and France's policy in determining the partitioning of Europe was dictated in some measure by security and fear. France was anxious that Germany should never again be in a position to wage an aggressive war on the rest of Europe. This anxiety modified somewhat the partitioning of Europe on the principle of self-determination of peoples. Also the new Russian Soviet State had made a separate peace with Germany, and it was developing on the basis of a political ideology repugnant to the Western powers. After the October Revolution of 1917 and the peace of Brest-Litovsk on December 15 of the same year, Soviet Russia was regarded as an enemy state, and efforts were made by the Western powers to reinstate the old Tsarist régime. These factors influenced considerably the partitioning of Europe in the East and influenced the application of ethnic determination.

The changes in the map of Europe occurred principally as a result of the peace treaties. The frontiers determined by these treaties were in some cases altered by subsequent wars, as in the case of the Russian-Polish war of 1919–20 and the Greco-Turkish war of 1920–2. By the Treaty of Versailles, signed on 28 June 1919, Germany ceded on her western frontier Alsace and Lorraine to France, and the Saar, which was to be subject to a plebiscite in 1935, and Eupen and Malmédy to Belgium. To the north Schleswig was ceded to Denmark. On her eastern frontier she lost a large proportion of her territory to the new political state of Poland, including a corridor to the Baltic, separating East Prussia and Upper Silesia to the south. The port of Danzig became a free city under the League of Nations. By the treaty of St. Germain-en-Laye with Austria, signed on 11 September 1919, and the Treaty of Trianon with Hungary, signed on 4 June 1920, the former Austro-Hungarian Empire was partitioned into a number of comparatively small states. Italy acquired the Trentino and part of Dalmatia from Austria, but not satisfied with this she seized Fiume from the Serbs in 1920. Romania was considerably enlarged. Bessarabia was seized from Russia and Transylvania and the Banat were acquired from Hungary under the treaties. The small states of Serbia, Croatia, and Slavonia, which were formerly parts of Hungary; Bosnia, Dalmatia, and Carniola, formerly parts of Austria; and Montenegro were combined into the new state of Yugoslavia. By the Treaty of Sèvres with Turkey of 10 August 1920 Greece was to acquire a considerable portion of Macedonia and Thrace from Turkey as far as Constantinople, but this treaty was never ratified, and after the war between Greece and Turkey, which lasted from 1920 to 1922, when the Turks drove the Greeks back to the Maritiza river, the Treaty of Lausanne was signed on 24 July 1923, which gave Eastern Thrace to Turkey. Bulgaria was altered but little, a small territory was ceded to Yugoslavia on the west, and part of Eastern Thrace was ceded to Greece, thus severing Bulgaria from the Aegean. The new state of Czechoslovakia in central Europe was formed of Bohemia, Moravia, and Silesia, formerly part of Austria, and Slovakia and Ruthenia, formerly part of Hungary.

In this partitioning of Europe Russia lost more territory than any of the defeated nations. Five new states were formed from the Russian western territories, Finland to the north, Poland, and the Baltic states of Estonia, Latvia, and Lithuania, while Bessarabia had been seized by Romania. The efforts to overthrow the Bolsheviks in Russia after the Treaty of Brest-Litovsk, which resulted in civil war in 1918–20, were supported by the Allies. Kolchak attacking from Siberia, Denikin from the south into the Ukraine, and Yudenish towards Leningrad, were all defeated in the autumn of 1919, due in some measure to the withdrawal of support by the Allies. This was followed in the spring of 1920 by an attack from Poland, whose troops invaded Russia as far as Kiev, but were driven back almost to Warsaw, when, with the assistance of the French, the Poles recovered, and in October 1920 peace was signed. It was as the result of this treaty of Riga that the eastern frontier of Poland was established. This frontier gave Poland much more territory than was proposed at the Versailles Conference.

The mixture of races that inhabit the eastern and south-eastern parts of Europe makes the establishment of frontiers on an ethnical basis an exceedingly difficult problem. I think, however, that it must be acknowledged that the map of Europe in 1923 was far closer to the geographical distribution of races than was the map of 1914. Where there was a mixture of races the only way was to determine the partitioning according to racial majorities. The minorities were in some cases large, and this presented a problem. Certain measures were proposed for the protection of such minorities, but these were not always observed. In Poland after the Treaty of Riga there were 7 million Russians and Ukrainians, and in Czechoslovakia about 3½ million Germans to 8¼ million Czechs and Slovaks. It has been argued that as these minorities are often on the borders of the state, and in some areas form a slight majority, the frontiers should be adjusted accordingly, but there are other questions of almost equal importance. In the case of Czechoslovakia the Germans inhabited the outlying northern tracts of Bohemia. The boundary of Bohemia is a natural geographical and historic demarcation, and lying just within it are areas providing economic resources on which the welfare of the state in some measure depends. Romania and Yugoslavia were troubled throughout the period with the claims of racial minorities and the claims of neighbouring States. In Romania about 70 per cent. of the population are Romanian, the minorities occurring chiefly in Transylvania and Bessarabia, but in the former there are twice as many Romanians as Magyars. The creation of Yugoslavia was to provide a country for the southern Slavs, but there were different nationalities among them, like Serbs, Croats, and Slovenes, whose interests had to be reconciled, and this was of the principal concerns of Yugoslav politics in the period between the wars.

There was considerable political and social unrest in the new, enlarged, and diminished states of eastern and south-eastern Europe in the few years following the war. The political systems were in process of formation and were constantly changed and modified. It is only in the countries where there was an established régime, or a degree of stability, that we can feel that the political system has some bearing on architectural expression in these first few years. We will find this in the victor and neutral countries and in Germany, Austria, and Czechoslovakia. In most other countries preoccupations with the evolving political and economic systems and general unsettled conditions meant that the little building that did take place was governed by what had been done before the conflict. This must also be said of most European building in this post-war period, but in some states returning economic prosperity and stability, and above all intellectual freedom, were an encouragement to architectural experiment, and this manifested in some of the countries indicated.

In thinking of the political systems of European states it is less important to classify them as monarchies and republics than as democracies and dictatorships. In a democratic country it is the political belief that the State exists for the people, that the people should enjoy freedom of thought and action, and that order and control are imposed to give people protection and security, and to ensure general well-being. But in a dictatorship the idea is disseminated that the people exist for the State, somewhat in conformity with the doctrine of Hegel, who conceived the State as omnipotent and divine, with the people subservient to the State. The State, through its dictator or government, imposes its will on the individual. Inevitably there are degrees of democratic freedom and dictatorship, and Europe between the wars provides examples of both extremes and much that is intermediate. Indeed, one country, Germany, had considerable democratic freedom until 1932, then there was a short period of transition, and after 1933 was subjected to a rigid dictatorship. We shall see it reflected in the architecture of the period.

From 1919 to 1923 the victor and neutral countries, with two exceptions, continued very much the systems that existed before the war. Although Great Britain, Belgium, Holland, Sweden, Norway, and Denmark were monarchies, they were, at the same time, democracies in which the Government was elected by representatives in Parliament, and a fair measure of freedom of thought and action was enjoyed by the people. The two exceptions were Italy and Spain. In the former a democratic form of government changed in the period after the war to a dictatorship under Mussolini, who was leader of the Fascist party and who formed a Government in October 1922. It was essentially rule by the Fascist party, all other parties were illegal, and even the forms of democracy disappeared. Fascism was to have considerable influence on the fate of Europe. The political system that it meant, which obtained in Italy from 1923 onwards, influenced that of many other countries, some of whom adopted systems based on similar principles. In Fascism the State is divine. All individuals exist for the State. It is thus intensely nationalistic and was largely responsible for the intensification of national feeling in Europe. Political liberty, and with it freedom of political speech in the Fascist State, is non-existent. State dominance invades all departments of life, the social and economic spheres, and even the arts and sciences. We will see its influence on architecture.

In Spain, where the parliamentary rule had for long been restricted by the power of the Throne and Army, a military dictatorship without a Parliament was established under General Primo de Rivera in 1923, to a considerable extent on Fascist lines.

The unsettled condition of many of the new states meant that only after a few years anything like a stable government was established. The Social Democrats were perhaps the most powerful political party in central Europe. They seized power in Germany, made the armistice possible, and accepted the peace treaty. Under the Weimar Constitution of August 1919 a democracy was formed which gave the people considerable freedom. J. Hampden Jackson[1] says that the Weimar Constitution

> was the most democratic that the world had seen. To give the vote of every individual its full weight, the principle of proportional representation was introduced by which a member was returned to the Reichstag for every 60,000 votes recorded, instead of a member for every constituency irrespective of the extent of his majority as in England and America. The Constitution affirmed the political equality of men and women and the completest liberty of worship, of speech, of Press, and of association.

In Austria during a period of economic distress a democracy obtained giving limited freedom, and with a tendency towards more and more dictatorship. In Hungary after a troubled period, when efforts were made to create a Soviet State, which was followed by Romanian incursions, the country gradually settled down under the Regent, Horthy, to a kind of mild dictatorship. Czechoslovakia, which formed its constitution in 1920, is an example of a successful democracy where freedom was valued and enjoyed. Finland would hardly be regarded as such a good example of democracy as Czechoslovakia. It was then a state where the social democratic party was conspicuous, and where there has been a measure of conflict between the well-to-do and the poor in which the interests of the former seem to have been more often considered. Poland, Romania, Yugoslavia, and Greece began the post-war period as democracies, but they all had minority problems and numerous political parties associated with these problems, and they were all subject to considerable political dissension. As we must observe later there was a tendency in all four to move towards dictatorships, which were later established. But in this first period they may be described as democracies disturbed by internal dissensions and strife with neighbouring states. Such conditions are obviously not conducive to economic and social progress. Turkey offers an example of a mild and discriminating dictatorship.

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[1] *The Post-War World* (London, 1935), p. 44.

Soviet Russia presents a certain parallel to Fascism in that it is a dictatorship by a political party, no other political party being allowed to exist. But that, perhaps, is the only similarity. In other respects the differences are conspicuous. Where Fascism is intensely nationalistic in aim Russian Communism is international. In Fascism private capital and enterprise obtain, in Soviet Russia there is state ownership, which, it is argued, is ownership by the people, and state control of production and distribution. A measure of private economy is, however, allowed. These conditions were not achieved immediately in Russia. During the wars from 1918 to 1920 Communism obtained, when state control of resources and their use prevailed and when socialization of the farms was attempted. This was followed in 1921 with considerable decline in production, and it also met with resistance from both industrial interests and from the peasants. Lenin, therefore, as a temporary measure, adopted his 'New Economic Policy', which meant a return to a degree of capitalism and private enterprise, in which peasants were enabled to sell for profit, and small-scale industry on a capitalist basis, giving scope for private enterprise, was allowed. But from 1921 the old system of capitalism and private enterprise was gradually submerged by the development of state organizations of production and distribution. Although the rule of the Communist party, accompanied by the suppression of all other political parties, was a dictatorship, there was otherwise a measure of democratic freedom. The various Soviet states, of which seven existed under the constitution of 1923, namely, the Russian Socialist Federal Republic, the original Soviet state and by far the largest, the White Russian, Ukrainian, and Transcaucasian Republics, and the Republics of Turkemenistar, Uzbekistan, and Tajikistan, all enjoyed considerable autonomy; while outside the political sphere, although there was a certain restriction to begin with, especially of philosophical speculations which showed a tendency to advocate alternative systems, there was, nevertheless, a breadth of view which differed from the narrow nationalism of Fascist doctrine. Soviet Russia was, after all, very much international in outlook, and it always championed the cause, not only of the workers of Russia, but of the workers of the world. In the arts, it is true, propagandist art in the service of Communism was looked on with especial favour, but artists were free to express themselves in any way they liked provided there was no propaganda in the interests of an opposing political system. Also, art movements in other countries were studied, and in the building of the new Russia the State invited the assistance of foreign architects, absorbing from other countries whatever was helpful.

The economic character of a country inevitably has a considerable influence on its building and architecture. Just before the First World War, and in the period between the wars, some of the most progressively experimental architecture has been in the sphere of industrial building. Also a country that is more engaged in industry would have more compact urban development in many areas, and would have larger and more numerous towns. The facilities and amenities of town life mean the provision of buildings of a greater variety than an agricultural economy would require. Thus it is inevitable that a big industrial country has a far greater opportunity to make a contribution to European architecture than one that is mainly agricultural. The countries of Europe in which there was the greatest proportionate volume of industry in the nineteen-twenties were Great Britain, Germany, and France; and Belgium, Holland, Czechoslovakia, Denmark, Sweden, Switzerland, and Austria among the smaller countries. If we exclude the people engaged in public administration, professions, the armed forces, and domestic service which in all countries is less than 25 per cent. of the occupied population, we find that in Great Britain about 90 per cent. were engaged in industry, trade, and transport; in Germany about 65 per cent., in France about 57 per cent., in Belgium about 77 per cent., in Holland about 71 per cent., in Switzerland about 70 per cent., in Czechoslovakia about 55 per cent., in Sweden about 52 per cent., in Austria about 58 per cent., and in Denmark about 55 per cent., the remainder being engaged in agriculture and fishing. In most of the countries in eastern and southern Europe the bulk of the population, on the contrary, was engaged in agriculture and fishing: in Poland about 82 per cent., in Romania about 85 per cent., in Spain about 65 per cent., in Italy about 60 per cent., and in Soviet Russia about 90 per cent., the remaining percentage being engaged in industry. The high percentage engaged in agriculture in Soviet Russia is based on the year 1926. Since then, however, there has been greater and greater industrialization of the U.S.S.R., and the proportion engaged in industry gradually increased since that date. In 1918 Lenin made vast plans for the industrialization of the country, and following the advocacy of Marx and Engels that electrical power is the basis of modern industry, he laid plans in 1918, with the assistance of the famous scientist Kvzhizhanovsky, for extensive schemes for generating electricity in potential industrial areas.

Industry is mainly concentrated in cities, and thus we find that a large industrial country is one of big cities, whereas a country engaged more in agriculture has smaller cities. The two chief industrial countries of Europe, Great Britain and Germany, are the countries with the largest towns, whereas countries like Poland and Romania, which are mainly agricultural, have fewer and generally smaller towns. Romania had a population of over a million more than Belgium and Holland together, yet these two countries had ten cities with populations exceeding 100,000, whereas Romania had only two such cities. England with a population not much more than double that of Romania has over thirty such cities. It is thus obvious that countries which are mainly industrial have greater opportunities for progressive building of considerable variety than countries which are mainly agricultural, and we will find that the most outstanding contributions to European architecture between the wars come in a large measure from the industrial countries like Germany, France, Great Britain, Czechoslovakia, Belgium, Holland, Sweden, Denmark, and Switzerland.

To summarize, we will find in our study of European architecture between the wars that the political character of a state affects the development of architecture in two principal ways: by the degree of freedom that it encourages in artistic expression, and conversely by the extent to which political and social ideas are imposed on artistic expression. The economic character of a state affects the development of architecture by the opportunity it provides for a variety of buildings, and we have noted that such opportunity is more fully offered where a country is to a considerable degree industrially prosperous.

We will find, however, that traditional style will have a stronger influence on architectural thought than economic factors. Such traditional influence is more closely connected with political circumstances. The most progressive and experimental building grows from traditional forms, but tradition often exerts authority and prompts repetition because the old forms have served well in the past, which is a reason for repeating these forms. It is very much a question of habit of thought, the tendency to look back or the tendency to look forward, which is perhaps the most powerful determining factor. And political circumstances affect this habit of thought. In the victor countries, suffering less disruption, there is naturally less questioning of tradition, for it is that traditional life for which men fought and which triumphed. There may be much desire for social improvement, and an acceleration of improvement, but generally it is a desire for improvement on the old lines, without anything in the nature of revolutionary change. In the defeated countries, however, there could hardly be that veneration for tradition, for traditional ways and the traditional life had not met with success. There was thus more questioning of tradition, and a greater interest in new life and forms. This was seen principally in Germany, and this is one of the reasons why for the decade following the war Germany produced the most progressive architecture in the world. It is not the cause, it is rather the stimulation of what had already been begun, because we have noted that before the war the new architecture was developing vigorously in Germany. In Russia, there was a revulsion from most that was traditional in political and social life, and thus an active criticism of anything emerging from Tsarist life. In building and architectural thought she had been considerably behind the principal European countries and there was much leeway to make up and much to learn. She did her best to use building and architectural talent found in other countries, and some of the best work in the early part of the period in Russia is the product of foreign talent, but generally Russia contributed very little to architectural evolution in the period between the wars. In discussing the period from 1933 to 1939 we will have occasion to seek the reason for this.

In the transitional period from 1919 to 1924 economic recovery, which would enable building to proceed, varied with the circumstances of each country. In the neutral countries like Sweden, Holland, and Spain there was less disruption, and building for peace-time needs, though considerably reduced, had never ceased and thus recovery was steadier and more rapid than in most other countries. In the victor countries, there was a boom for a period of two years followed by a slump, which retarded the building that had been commenced, and which reduced the number of new projects.

Building was not on anything like the scale that had been hoped, as can be seen from the housing failure, particularly in England. France and Belgium had difficult tasks of reconstruction because the devastated towns had to be rebuilt. Considering that she was the principal defeated nation, Germany's post-war building recovery must be regarded as comparatively successful. In the area of the extensive redistribution of sovereign territories in central and south-east Europe, where there was considerable strife and social unrest, building was late in starting on a reasonably big scale. But by the year 1923 a measure of economic recovery after the slump occurred in the victor countries, and a degree of stability, although broken by occasional strife and unrest, was returning to south-eastern Europe.

CHAPTER XVII

Housing

ONE of the great needs in Europe in 1919 was for houses. At the outbreak of war in 1914 hardly one country in Europe had satisfied the demand for dwellings consistent with a reasonably good standard of living. Keeping pace with the demand was most difficult in countries where there had been a rapid increase in population, in Germany, Great Britain, Holland, and Belgium; but in some countries where the increase had been less rapid, in France and Sweden, for example, the problem seemed hardly less acute, because, if the magnitude of the problem was less, the magnitude of effort to solve it seemed to be correspondingly less.

The larger industrial countries, England, Germany, and France, were each confronted at the end of the war with a shortage of at least a million dwellings. The greatest shortage of all was probably in Russia, but owing to the continued attacks on the Soviet Union, internal strife, and famine, the rectification of this shortage had to be delayed for some years after most other countries had made some advance with their housing. The more urgent task of feeding this vast and increasing population had to be undertaken first. Later the Soviet Government endeavoured vigorously to alleviate this housing shortage.

In the belligerent countries there was a certain amount of housing by Government and Municipal Authorities for war-workers, and some of these schemes are interesting as planning and construction,[1] but they were generally on a small scale. Building other than for war needs had practically stopped in belligerent countries, while in the neutral countries it had been greatly reduced. But the neutrals had the advantage of avoiding that break in the operations of their building industries that was inevitable with the belligerents. Thus, recovery for the neutrals was less difficult, and it is therefore not surprising that the results achieved by them in planning and housing in the early post-war years compare favourably with that of the belligerents. The best results from 1919 to 1924 were achieved in Holland.

In considering housing in this post-war period it is necessary to separate schemes of an emergency nature, some of which were of a temporary character, from houses built in conformity with long-term planning. In trying to provide houses quickly it was not always possible to wait until fairly extensive plans for residential areas could be put into operation. In some cases, however, plans had been prepared before the war, and facilities for putting them into operation were less subject to delay than entirely new plans; also many schemes had already been begun and operations had been merely suspended. But such schemes were altogether inadequate compared with the demand. To meet this demand many new plans had to be prepared, and suitable land had to be acquired before the houses could be erected. Looking back it may be said that one of the reasons for the failure to build houses at all commensurate with requirements was that plans were prepared too late. For example, the London County Council prepared a large number of plans in 1919 and 1920 for block dwellings in the centre and for cottage estates on the outskirts: large schemes like those at Becontree, Roehampton, and Bellingham, none of which was commenced before 1920 was well advanced, nearly two years after the Armistice; while in many estates which had already been begun well before the war, like White Hart Lane Estate, building was not restarted until 1920. If more plans had been prepared during the war and the Government had given facilities for putting these plans into operation immediately the war was over, and had exercised adequate control over the prices of building materials, England might have built the million houses which she wanted in the period of 1919–23 instead of a mere 250,000.

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[1] In Sir Lawrence Weaver's *Small Houses and Cottages* (London, 1925) there is an account of some of the war housing in Great Britain at Gretna Green and Dormanstown.

The high cost of materials was perhaps the most important reason for the failure in most countries in Europe to produce houses on a scale commensurate with demands. The difficulties were considerable in the victor countries, Great Britain, France, and Italy, but they were much greater in the defeated nations. In England in 1921 the price of timber was 300 per cent. above 1914 prices, sanitary fittings 284 per cent., slates 225 per cent., lime 200 per cent., and these coupled with an increase in labour cost of 170 per cent. meant that it cost 250 per cent. more to build a house in 1921 than in 1914. In Holland during the years 1919, 1920, and 1921 the increase above pre-war cost for building houses was between 250 and 275 per cent. In 1922 prices began to fall, and in 1924 were about 150 per cent. above the pre-war level.[1] It was much the same in France, Belgium, and Italy, and the Scandinavian countries. Rigorous government control of the price of building materials was a solution which most governments seemed reluctant to adopt. The rising cost of building materials while wages did not increase to the same extent meant that the gap between the cost of houses and the wages of the majority was becoming greater. Before the war the gap had never been closed; in fact it had been increasing, and after the war it widened to an extent that imperilled the foundations of economic life. Because poorer people could not afford dwellings supplied by private enterprise, housing for the lower-income groups was becoming more and more a public concern and a matter for which governments and municipal authorities were making themselves to an increasing degree responsible. Subsidies had been given in some cases by governments, and by the municipal authorities. After the war, to solve the difficulties created mainly by the high cost of building materials and a general lack of preparedness with planning and housing schemes, municipal authorities took a greater share in the provision of houses for the lower-income groups; while to meet the greatly increased cost of building some governments gave subsidies for houses erected both by municipal authorities and by private enterprise. This policy of subsidies was adopted in Great Britain with the Act of 1919; in Germany and Holland the housing subsidies which had already existed since the beginning of the century and in France since 1912 were extended, while in Denmark and Sweden special subsidies were granted from 1917 to 1922 to meet the high cost of building. In most countries of Europe in the decade following the war the majority of houses were built with official aid.

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[1] *Amsterdam: Development of the Town Housing Improvement* (Town Printing Office, Amsterdam, 1924), p. 26.

The difficulties were especially acute in the defeated nations. Their failure to provide dwellings that were urgently wanted, particularly by the poorer people, was not wholly their responsibility. The uncertainties that existed until the peace treaties had been determined, the solution of the greater problem of feeding the people adequately and of reducing the numbers dying from malnutrition, the extensive alterations in national boundaries and the strife attending these adjustments, made it very difficult to formulate an adequate housing policy in the immediate post-war period. Especially was this the case among the countries in eastern and south-eastern Europe, where territorial changes were most extensive. The migrations of population that these alterations of boundaries and the attending strife involved aggravated the difficulties. The shorn countries of Austria and Hungary had large influxes of refugees. In both, want and starvation were acute, and there was little opportunity for ambitious planning and housing schemes in this period of emergency. In Vienna, where conditions were very serious, the Socialist City Council attacked the difficult problem with vigour. High tenement dwellings built close together represented much of the unimaginative housing of working people in the previous fifty years.

From 1919 to 1923 every available emergency accommodation had to be utilized. One thousand three hundred families were housed in old military huts and barracks, extra stories were added to existing low buildings, dwellings begun in pre-war days by private enterprise were completed, and a colony of houses was built in the old Schmetz Parade Ground. In this way 3,673 homes were provided by 1923.[1] Planning and housing on an ambitious scale and of a progressive character was to come later, and it is interesting to note that with these initial disadvantages Vienna in the following decade was to be responsible for housing that, of its kind, was second to none.

Germany did not have quite the same almost overwhelming difficulties with which to contend as the small countries of south-eastern Europe. Germany was fortunate in having a democratic and progressive government, she still retained over four-fifths of her territory and population, and she was not confronted with quite the same problems of redistribution and adjustments that confronted the countries in the south-east. With the exception of Russia, her population of 65 million people was still the largest in Europe and her area was only slightly less than that of France and Spain. Before the war it had been necessary to maintain a high annual production of dwellings of about 200,000 to meet the demands of her rapidly increasing population, but this production had proved insufficient, and like other countries she still had a housing shortage at the outbreak of war. Her financial difficulties and inflation proved a great obstacle, but when the currency was stabilized in 1924 this difficulty was, in some measure, removed. In 1919 and 1920 the emergency accommodation it was necessary to provide for families with no homes of their own was obtained mainly by converting old barracks and large houses. This was done chiefly by municipalities. In addition to subsidies for housing schemes, towns were greatly assisted by the extension of municipal ownership of land. Much of the best housing in the early period was accomplished by a policy of decentralization from the congested areas of the large cities, a subject which claims some consideration later.

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[1] See *Europe Rehoused*, by Elizabeth Denby (London, 1937), p. 151.

CHAPTER XVIII

The Rebuilding of the Devastated Towns of France and Belgium

THE rebuilding of the devastated towns of France and Belgium was a special problem dealt with by special measures of the respective governments. The principal cities and towns in France were Albert, Arras, Bapaume, Peronne, Soissons, Rheims, and Verdun; in Belgium, Ypres, Menin, Roulers, Dixmude, and Nieuport. The policy in rebuilding these towns was dictated in a large measure by sentiment. There seemed to be a general desire to replan and rebuild them very much as they were before, but a distinction was made between the old and important buildings, and the majority of the houses of the working people. The opportunity was taken to effect improvements in the housing in these towns, but the old and important buildings reappeared generally as approximate copies of what they had been. This was particularly the case with Belgian towns. In reproducing the old buildings it was necessarily the desire that they should be rebuilt precisely on the old sites so that the buildings and their surroundings should be a close approximation of what memory cherished. 'These plans', says Émile Cammaerts, in describing the work,[1] 'have invariably been drawn up on traditional lines, that is to say with the idea of reconstituting every feature of the old building. Whenever a new departure has been made, it has only been for the purpose of replacing some modern-looking edifices by new ones in the Renaissance style more in harmony with the chief buildings, so that, as soon as time and weather have exerted their beneficial influence, some sites will actually appear older than they did in pre-war days.' Thus we find that the old and important buildings of pre-war days, and with them their settings of picturesque narrow streets, reappeared. By the beginning of 1925, of 1,175 public buildings destroyed, 1,040 were rebuilt, mainly reproductions of what they once were. An example of rebuilding is provided by the little town of Nieuport, which was completely destroyed. The thirteenth-century church of Notre Dame was rebuilt almost exactly as it was before, the fifteenth-century Cloth Hall was similarly rebuilt, while the variation on the pre-war town was towards further Renaissancizing by replacing the modern houses which stood to the right of the Cloth Hall with a sixteenth-century Town Hall. Other towns were rebuilt in a similar spirit, and Émile Cammaerts remarks that the restorations 'may be considered as entirely successful, owing to the scrupulous care which was taken only to depart from the original plan in very exceptional cases, and when the first building had been manifestly tampered with by former restorers'. The sentiment that prompted this rebuilding can be understood, but it arises from the tendency to look back rather than forward. The more progressive and vigorous spirits might regret that the opportunities to improve the towns were not more widely taken so as to make them better and more serviceable settings for social and commercial life. The streets as rebuilt are too narrow to accommodate adequately the increasing and speedier modern transport, while the congested character of many of the centres is certainly not so conducive to easy movement and town expansion as more spacious planning would have been.

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[1] 'The Reconstruction of Belgian Towns', *Journal of the Royal Society of Arts*, vol. lxxiii, pp. 538–48 (24 Apr. 1925).

Considerable improvements in housing, however, were effected in these Belgian towns, and it was no mean achievement that out of 100,000 houses destroyed or badly damaged in Belgium 95,000 had been rebuilt by the end of 1924 to greatly improved standards. 'Most of the new houses', claims Émile Cammaerts, 'are more comfortable and more solidly built than the old ones', and measures have been taken to avoid new slums. A minimum standard was defined which required that each dwelling must have at least four rooms[1] and that they must fulfil the requirements of modern hygiene. These dwellings in the rebuilt Belgian towns, most of which conform to the standards defined, replace the old picturesque but often insanitary cottages; indeed, the process of rebuilding meant both in the Belgian and French towns a replacement of many slum areas with comparatively good housing.

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[1] Émile Cammaerts states that each dwelling must cover a total area of 160 square feet. This is obviously too small. He has either made a mistake or it is a misprint. From another source the standard is given as 42 square metres, which is more in the region of 400 square feet.

CHAPTER XIX

Urban Overcrowding and Planned Dispersal

THE problem presented by the overcrowding of cities and the urban sprawl into the country side had been felt in the early nineteenth century, and it was one of the reasons that prompted Robert Owen to plan his villages of 'Unity' in 1818, and Buckingham, Howard, and others to plan model towns as described in Chapters XIII and XIV. It will be remembered, too, that in 1845 Moffat proposed to build garden villages on the outskirts of London. As we have seen, this problem was becoming more and more acute. It existed in all the large cities of Europe, in London, Berlin, Paris, Vienna, Manchester, Liverpool, Glasgow, Hamburg, Stockholm, Amsterdam, and in many others in varying degrees. There had been agitation for years for measures to secure an abatement of overcrowding; and we have seen that the movement away from the centre of London had begun with the flight of the middle classes to the suburbs, followed by the slum-clearance schemes and the provision of housing estates on the outskirts by the London County Council. What had happened in London happened also in many other European cities. But there was considerable dissatisfaction among planners with the way it was done. It was argued that the decentralization was so often merely a lateral extension of the city, merely further urban sprawl, so that the country was retreating more and more from those who lived in the centre. The solution, it was argued, was not the suburb but the satellite town, which, like the garden city, should be socially comprehensive. Like that, it should have its own industries, so as to secure a satisfactory relation between a man's home and place of work; it should have adequate shops, educational and recreational facilities, and it should be large enough to support these in fair measure, but above all it should be surrounded by a rural belt. It will have been seen that this idea of the garden city had exercised a wide influence in Europe before the First World War and that many attempts were made to build them. Only Letchworth, however, was a complete example. There was too often no clear distinction in the minds of planners between the garden city and garden suburb.

The conviction was growing among enlightened planners and sociologists that planning should no longer be local in character, with planning schemes terminating at the city or town boundary, but that they should be regional in scope and comprehend the whole urban development in any particular area. Most industrial areas in Europe consist of clusters of unseparated and indistinguishable small towns generally with one larger central town. Examples are the small towns grouped round London, Berlin, Paris, Hamburg, Cologne, Brussels, Birmingham, Manchester, the cluster of towns in the Ruhr and in the pottery district of England, and many other similar areas. About 1870 these were much smaller towns, each separated from its neighbouring town by rural areas. But with the increase of industry and population they gradually spread towards each other, and joined, so that the whole of each area became one great industrial, urban mass, with only a few open spaces which, in their location, are no longer indicative of town boundaries. Manchester, which affords a good example of this, is surrounded by sixteen boroughs which, with Manchester, have spread and joined up in one vast conurbation, as Patrick Geddes calls it. The necessity of planning these areas as a whole was being more and more realized, so that the extensive urban and industrial sprawl unbroken by open spaces and rural belts could be checked in the interests of health and good living conditions. But planning of this regional character remained for the most part the conviction of an enlightened and progressive few, and it recommended itself only very slowly to governments and municipal authorities; while there was always opposition on the part of small boroughs to sacrifice any of their powers to a regional planning authority. County planning authorities, determined in their jurisdiction by ancient boundaries, have little relation to the realities and needs of planning.

During the First World War there was a general feeling that there should be efforts to build a better world, and this was supported by a degree of propaganda, calculated not without its effect on morale. In the sphere of planning and housing it was merely emphasizing what many planners and sociologists and a few architects had been advocating for years. When the war was over the same theme was continued. Lloyd George, in a speech at Wolverhampton shortly after the Armistice, said, 'We must make Britain a fit country for heroes to live in.' He continued: 'Slums are not fit homes for the men who have won this war or for their children. They are not fit nurseries for the children who are to make up an imperial race, and there must be no patching up. This problem has got to be undertaken in a way never undertaken before, as a great national charge and duty. It is too much to leave it merely to municipalities.... The housing of the people must be a national concern.' Yet, if we judge by the first five years, England failed and failed miserably in this task. Why? I have already indicated two reasons: that of lack of adequate control of the prices of building material, and because of lack of preparedness with planning schemes. Lloyd George was too late. What has been quoted should have been said and acted on in 1916, and government machinery and plans prepared so that a fair planning and housing programme could have been put into operation immediately the war was over.

Everybody agreed that such an aim as Lloyd George indicated was right, and should be resolutely pursued. They probably agreed in every country in Europe. Yet the means whereby it might have been accomplished were rejected because of other interests and because of sentiment. On the one hand there was objection to controls which were essential to the work of reconstruction. People cried out for a return to the so-called freedom of 1914. On the other hand there was considerable nonsensical and sentimental objection to planning. People confused the issue and thought their lives would be planned for them. Sentimental architects like Voysey and Baillie Scott wrote articles objecting to control and planning.[1] The former says: 'Town planning is the outcome of a belief in a fundamental principle which is false. The principle is collectivism. The drilling and controlling of the multitude—the formalism of Prussian militarism.' The thought here is as muddled as the expression, and yet it was widely shared and it presented one of the great obstacles to regional planning and to the improvement of home environment in this country. Such opposition occurred in other countries, but in some of the smaller nations like Holland, Denmark, Sweden, and Norway, the ideas of regional planning and housing as a responsibility of the State had made more progress.

This opposition did not deter the eloquent and vigorous advocacy of regional planning and of the necessity of comprehensive measures to get rid of slums and to develop residential areas with adequate space, good surroundings, recreational and cultural facilities with the country within easy reach of those who live and work in the town. To give the majority of people such conditions of life could be accomplished only by taking them from the congested centres of the cities and providing accommodation for them elsewhere, by the enlargement of small towns and villages, by new towns, or by further suburbs. The objections advanced by many planners to further suburbs that they would just add to the evils of urban sprawl already indicated, that each suburban addition would not have a corporate life of its own but merely be a small insignificant addition to the existing colossus, were very largely ignored, as also was the solution advocated by many planners and sociologists throughout Europe of regional planning by means of satellite towns. F. J. Osborn has told[1] how he, C. B. Purdom, and other followers of Howard had written 'articles in popular papers, lobbied political parties, and toured mayoral parlours in an endeavour to get the Government and the great municipalities to translate our very practical proposals into action'. Early in 1919 the Garden Cities and Town Planning Association presented a memorandum to Dr. Addison, President of the Local Government Board, in which it proposed that a committee should be formed to consider 'the development of new industrial centres on the garden city principle' and also that there should be a national town planning commission with regional officers. The official reply was that there was no time to consider such proposals until the housing problem had been dealt with. Official blindness could not see that here were real proposals which could form a substantial basis for better housing and for better home environment.

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[1] *The Architectural Review*, vol. xlvi, 1919, 'On Town Planning', by C. F. A. Voysey, p. 25; 'The Charm of National Planning', by Baillie Scott, p. 43.

The advocacy of planned dispersal, both of population and industry, to be accomplished by regional planning with a system of satellite towns built on garden city principles, was confronted very largely with an apathetic public. To the majority the ideas savoured of Utopianism, and, therefore, were regarded as not entirely practical. Like all great social ideas that appear new it took time for them to gain acceptance. Still something was done. Referring to the most important post-war step F. J. Osborn recalls that, whilst he and others were engaged in vigorous propaganda, Howard had secured a site for the second garden city of Welwyn, which C. B. Purdom calls the first satellite town.[2] The enthusiasts had wanted several, sufficient to accommodate a fair dispersal of population from overcrowded centres. They had got one.

The land for this new garden city covers an area of 2,378 acres (with a few small additional areas that have been acquired from time to time), lying twenty miles to the north of London and served by the railway from King's Cross. It was planned by Louis de Soissons, and work commenced on the site in 1920.[3] It follows the principles which determine the planning of Letchworth. It is to be limited in population to 40,000 and is surrounded by a permanent rural belt. It is designed so that most of the people living there shall work there, and a full measure of recreational and cultural facilities are being provided as it grows. The town is planned for varied income groups and aims at a social mixing of these groups.

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[1] F. J. Osborn gives this account in the preface to the second edition of *New Towns after the War*, published in 1942. The first edition was published in 1918 as by New Townsmen, who were F. J. Osborn, W. G. Taylor, and C. B. Purdom, but written by the first-named.

[2] An excellent exposition of satellite towns, and a description of Letchworth and Welwyn, are given in C. B. Purdom's *The Building of Satellite Towns* (London, 1925); Part 3 is devoted to Welwyn Garden City, the first satellite town.

[3] It was taken over by a Development Corporation in 1948.

The main railway from London runs south–north through the heart of the town. A single-track railway branches east to Hertford and one branches west to Luton. The industrial area lies to the east of the main railway and along the eastern branch line, and the town centre lies to the west. The residential areas are on both sides of the railway, the largest being to the west, another south-east, and a small area to the north of the factories.

Some of the site planning for the houses is interesting and shows considerable advance in ingenuity and variety on Letchworth. This is achieved by the employment of the close or cul-de-sac running off from the traffic road. This has numerous advantages. It is more economical because there is not the same length of through-traffic road required for residential areas, the culs-de-sac can be lightly constructed service ways, while they ensure a greater degree of quiet and safety for children than through roads. The architectural effect can often be very pleasing if the houses are well designed. Barry Parker has employed this cul-de-sac planning, often with an octagonal arrangement of houses, with some measure of success at Earswick, and there are a few attractive examples in Hampstead Garden Suburb. Louis de Soissons employed many different types of cul-de-sac, which give considerable variety to the residential areas (Plate XLIII). But formal geometric patterns determine the planning, and if the houses are to be satisfactorily orientated, plans must be varied according to position. The planning of houses should begin with a consideration of what is most agreeable to the family, and a house in a northern climate should surely be orientated according to the sun. No room should face north, but in these culs-de-sac these considerations are necessarily subservient to siting according to geometric patterns. They may give variety and interest and a certain picturesqueness, but it is questionable if planning here starts at the right point. It would be better to let the grouping of the houses round the cul-de-sac be determined by the sun than by geometric patterns. The grouping of houses for American war-workers at Aluminium City near Pittsburg, built in 1943, offers an illuminating contrast. These houses, designed by Walter Gropius and Marcel Breuer, are sited irregularly according to the sun, and with complete disregard of any formal or geometric layout. They represent the culmination of twenty years' progress in this matter.

The early houses in Welwyn Garden City are mostly the traditional type with a greater degree of simplicity than in most of the houses in Bournville, Port Sunlight, and Letchworth. The plain wall is often used with good effect, one noteworthy example being the houses in Handside Close, designed by Louis de Soissons. There is still, however, in most of the small houses the reminiscence of the medieval cottage with its small windows.

What enthusiasts for large-scale measures, regional planning, garden cities, and satellite towns had recommended was to continue an unrealized ideal, a dream until after the Second World War. Instead, piecemeal, small-visioned planning producing the further urban sprawl into the country-side continued by means of new suburbs. The London County Council contributed to this with its cottage estates, some of which had been begun before the First World War, while others were planned in 1920 and developed a little later, as previously noted. The most ambitious of these is Becontree, covering an area of 2,770 acres, which the London County Council claims to be the largest municipal housing estate in the world.[1] It lies to the east of London, just beyond Ilford. Five hundred acres are reserved for open spaces, 118 acres of which form the large central Parsloes Park. The estate is planned for 25,039 dwellings, to give accommodation for 112,570 persons, mostly displaced from the over-crowded areas of the County of London. The best that can be said for Becontree is that it provides better accommodation for most of the people who came to live there from the slums. But contrast it with Welwyn Garden City. Welwyn covers approximately the same area. It is to have a maximum population one-third that of Becontree. Being completely surrounded by country it has an identity and corporate life of its own, providing its own amenities, whereas Becontree, instead of being surrounded by country, is joined on to Ilford as another vast suburb with insufficient amenities in its own area. In Welwyn most of the people who work there live there, whereas in Becontree most of the people go elsewhere to work, mostly to London—a none-too-pleasant journey. The people who work in many of the neighbouring factories, such as Ford's, at Dagenham, have found it difficult to get accommodation in Becontree because the persons displaced from London, most of whom go there to work, have priority. All classes of society live in Welwyn; in Becontree one class is segregated together. Lastly, Becontree is built on first-class arable land, thus some of the best food-growing land in the country, yet hardly any of it is used for agriculture. Welwyn is built on arable land less valuable than that of Becontree, yet half of it is used for agriculture in the form of a green belt. Welwyn belongs to that brave new world full of promise and happiness, Becontree to a continuation of that dreary unimaginative world that has been so often the setting of the Industrial Revolution.

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[1] *London Housing* (published by the L.C.C., 1937), p. 154.

Although the authorities in other European countries seemed generally as slow as the authorities in England to realize the value of planning on a regional scale, where the region is determined, not by ancient boundaries, but by modern urban and industrial development, there are some noteworthy and enlightened exceptions. One of the most ambitious and comprehensive of these regional schemes is that of the Ruhr district in Germany, comprising 1,482 square miles in which is a population of 4 millions and over 300 local authorities. The planning of this vast area is the responsibility of a Federation appointed in 1920, and its function is to determine the main lines of communication, to criticize and assist in the preparation of town plans, to reserve open spaces, and to sanction new housing schemes. A step towards regional planning was made in France with the Town Planning Act of 1919, and in accordance with the Act Paris and the Department of the Seine organized a competition for the planning of the region surrounding Paris. Many of the schemes submitted recommended dispersal by means of satellite towns and garden cities. Holland and Italy provide examples of large areas of reclaimed land, the Zuyder Zee and the Pontine Marshes, which are planned as a whole. The former was begun in 1920. It is to be developed in sections and will cover a total area of about 865 square miles. The first district, Wieringermeir, to be developed covers an area of about 77 square miles and consists of fourteen villages. Housing, agricultural, and industrial areas are planned in satisfactory and convenient relationship. Each village is provided with essential educational and recreational facilities, including a school, a cinema, and places of worship. The planning of the reclaimed Pontine Marshes, covering an area of 300 square miles, was begun several years later.

Most regional plans in Europe were concerned with dispersal and avoidance of further congestion of the big cities, and although few were on the scale recommended by enlightened and progressive planners, and although it may be a long time yet before these few plans are completely realized, yet, as has been shown, a start was made with some, while modified schemes on a much smaller scale have in some cases been adopted. In Germany the policy of building garden suburbs was extending, and few big German cities are without them. Several were developed shortly after the First World War. Good examples are those planned and built by Peter Behrens in the vicinity of Berlin, Neusaburg (1919), Nowawes near Potsdam (1920), and Forst in the Lausity (1919). But though garden suburbs were being extensively planned, the idea of the complete satellite town planned on garden city principles, like Letchworth or Welwyn, was not evolved as many planners wished. The nearest approaches to the more complete satellite towns were those mentioned in Chapter XII. Hellerau, north of Dresden, and Altona, near Hamburg, continued to be developed after the war. Hellerau, a little over 500 acres in extent, is obviously too small for satisfactory development as a town. It is not merely an outlying suburb, however, for a few industries are established there so that many of the people who live there shall also work there. Altona is much larger. Peter Behrens was responsible for several of the estates built there after the war, in 1920. We have already noted that Behrens in his early house designs was greatly influenced by English domestic architecture, and this influence is still apparent in many of the houses in Altona, with their plain brick walls, windows reminiscent of English Tudor, and large expanses of roof with 45 degrees pitch (Plate XLIV). Dutch influence is probably also a factor. Hilversum in Holland and Zlin in Czechoslovakia are industrial towns which have been considerably developed between the wars. The planning of each has clearly been influenced by garden city principles, and each has a distinct identity and corporate life of its own. I will have occasion later to deal with some of the noteworthy architecture in these towns.

Stockholm provides an interesting example of satellite estate development. The municipal authority had been acquiring land on the outskirts for a decade before the war to be developed as estates of family houses. Several of these estates were being developed in the post-war period. They were spaciously planned, and each estate was in a large measure surrounded by open country. A large number of the houses are built of timber and were erected by the tenants or owner-occupiers. These estates are often called garden cities, but they have not the social comprehensiveness of the true garden city as developed in England according to the ideas of Howard. They are suburbs in a sense, but they do not continue the urban sprawl into the country, as they are often separate residential entities surrounded by green belts.

Schemes for satellite town or satellite estate development have been prepared for many Scandinavian cities. In Copenhagen there has been a development of satellite residential districts, mainly at the junctions of main roads.[1] These districts are developed under garden city influence, but they are too small to be regarded as good satellite towns. A scheme for the building of several satellite districts of Trondhjem, in Norway, was prepared by Sverve Pedersen in 1918. The town of Stjordalshalsen, planned by Pedersen in 1920, was built fifteen miles to the east of Trondhjem, but this is obviously too far away to be regarded as a satellite of Trondhjem. This new town, although small, is conceived with the social comprehensiveness of a garden city.

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[1] A plan of this is given in Plate I of C. B. Purdom's *The Building of Satellite Towns*.

CHAPTER XX

Planned Expansion

EXTENSION by means of satellite towns presupposes the desirability of limiting the size of cities. In unchecked urban sprawl of big cities, the delights and benefits of the country which are especially important to children are more difficult of access. Thus, it is argued, in the future towns should be limited in size, and many of the large congested industrial cities should gradually be reduced in population by dispersal. The social and economic advantages of this are being more and more realized, and it is regrettable that governments did not pay more attention to such recommendations in the post-war period of 1919–24. London, the worst example, continued its haphazard urban sprawl and enlarged its population by nearly 2 millions between the wars. Amsterdam, on the contrary, is an example of planned expansion on a regional scale, not by satellite towns but by continued urban extension, and it is a plan that has been much praised by those who do not wholly favour satellite town and garden city development.[1]

Amsterdam had increased rapidly in population since about 1880, when it was 330,063. In 1921 it had risen to 683,136. Since 1866 plans had been considered for the extension of the city, but little of an ordered character had been done until the present century. Accommodation for the increasing population had been provided by closer building in the centre by means of tenement blocks. The consequent congestion gradually resulted in slums, and thus the merchants and well-to-do who had lived in the centre, often in houses which also formed part of their business premises, finding the city a less and less pleasant place in which to live, moved to the outskirts. Their vacated premises were often occupied by many poorer families. Amsterdam was but one example in this respect of what happened in most of the large cities of Europe. I have already referred to the process in London.

Amsterdam lies to the south of the confluence of the rivers Y and Amstel. It has been developed mainly on a half-spider-web plan formed largely by intersecting canals, and surrounded by a city wall. This has long been regarded as a classic example of organic planning. Lewis Mumford says of it that, though it is geometrical, it 'is a magnificent adaptation to economic and social opportunities'.[1]

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[1] Siegfried Giedeon, for example. His description of the Amsterdam plan, given under the heading of 'Amsterdam and the Rebirth of Town Planning', appears in *Space, Time and Architecture* (1940), pp. 517–38.

The plan of 1866 was prepared for extension all round the city walls. Based on formal classical geometric principles, in which the grid-iron and radiating systems and handsome boulevards were conspicuous, it had some degree of unity, fairly satisfactory relation of parts, and included a generous provision of open spaces. But the plan was not followed and extension was left mainly to haphazard private development. In 1902 a plan was prepared by H. P. Berlage for the southern extension. Nothing was done, however, until 1915, when Berlage revised his plan, and the extension was commenced shortly afterwards mainly on the lines of this plan, which, however, is of a general character subject to modification by the municipality. It is much freer, less rigid, less geometric than the scheme of 1866. Medieval influence, via Camillo Sitte, is mixed with classical tradition, but the latter is still strong. Wide boulevards allowing garden strips and trees are conspicuous, but what is important is that each street is conceived as an entity and Berlage insists that the dwellings in a street should be designed as a whole. He advocates block dwellings as most satisfactorily conducive to this architectural unity. This southern area of Amsterdam is developed on these principles and the block dwellings present some of the most interesting examples of modern Dutch romantic architecture in the work of M. de Klerk, P. L. Kramer, and others, with which I will deal in a later chapter.

Wide boulevards, fine unified architectural effects mingled with greenery, symmetrical planning in spite of a tincture of Sitte's medieval influence, this is fundamentally formal classical conception. The planning starts with an aim at fine appearance. The orientation of the blocks of dwellings is not dictated mainly by family needs or by the sun, but by the geometrical layout of streets (Plate XLIV).

This extension to the south meant that the country was no longer so readily accessible, and a considerable number of parks were provided as compensation. When the city extended only a little beyond the city walls, the need for parks was not felt. It is a question, therefore, whether the extension has been wise. Do parks compensate for the loss of open country on the boundaries of a city limited in size? Would it not have been better to have planned this extension as a satellite town ten miles farther out? The same question arises with the garden villages and communities that are being developed to the north of the city on the farther side of the River Y.

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[1] *Culture of Cities* (London, 1938), Plates 16 and 17.

Among these communities or garden villages are Buiksloterham, Oostzaan, and Nieuwendam. The influence of the English garden city is apparent, but they cluster far too closely round the city, and in this they share the planning defects of the London County Council cottage estates.

I have dealt with the planning of the southern extension of Amsterdam because it provides one of the best examples in Europe of a school of thought in planning which is opposed to the garden city, satellite town school. It is a school which believes in the planned extension of the big city, with the provision of ample open spaces for physical recreation; and believes in handsome, dignified appearance as a principal aim to be achieved by formal planning, with the street as the unit to be designed architecturally as a whole. It is essentially the architect's vision, whereas the garden city is essentially the sociologist's. Which is closer to human needs and desires, which considers more directly the welfare of family life, its freedom, and the growth and delight of children? In a residential area, and the greater part of every town is primarily that, these are the fundamental questions in planning, and these human considerations must be the starting-point. There can be little doubt that the garden city and satellite town method of extension serves these fundamental human purposes better than suburbs finely planned on formal geometrical lines.[1]

Numerous theoretic town-planning schemes were prepared at this time. As in the past, they were prepared with the idea of providing a solution of the social and economic evils like overcrowding and slums, transport congestion, separation of homes and places of work, scarcity of open spaces and inaccessibility of country, that had arisen from haphazard urban development; and they mostly belong to the two schools of thought, the advocates of the garden city and satellite town, and the advocates of planned city extension. Paul Wolf, who was city architect of Dresden, belongs to the former school. He prepared a plan of groups of three garden cities with a maximum population of 100,000. The garden cities occupy the corners of an equilateral triangle, each being surrounded by agricultural land. Three principal avenues run from the central open space of each garden city and meet in the centre of the triangular space where there is an administrative building. An avenue runs between each town and is crossed by a main road which connects the towns laterally. In another scheme for a satellite town Paul Wolf plans it as an elliptical diagram, with administrative, cultural, and recreational buildings in the centre, then an elliptical residential area, then a green belt of gardens, then a belt of houses and gardens, and then the open country. The industrial area is to the east a little separated from the town.

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[1] There is not space to give my reasons here, but some of them are given in my little book *Civic Design and the Home* (London, 1943), where I discuss with men and women in the Forces the sort of dwellings and environment that satisfy family needs.

In 1924 Adolf Rading prepared a plan for a city on the green wedge principle. The central town is compact and closely populated, and four wedges of agricultural land penetrate almost to the centre of the town. Between these wedges beyond the town are residential areas interspersed with pleasure- and market-gardens and orchards. This green-wedge principle was to be developed by later planners, and was to become an important feature of the development of many important cities, Moscow being a conspicuous example.

The planning theory that excited the most widespread influence at this time was that of Le Corbusier, which he evolved between 1915 and 1922. From his reflections in *Vers une architecture*, published in 1923,[1] it would appear that his idea for his city had its germ in a report of an interview that Auguste Perret had with a reporter of the *Intransigeant*, describing an idea for a city of towers. This seemed an original idea, but there were certain somewhat extravagant and fantastic features in Perret's scheme which Le Corbusier endeavoured to rationalize. The centre of the city was to consist of a group of towers, each designed on an equilateral cross plan, which were to house the business and administrative offices. Near these are the civic and entertainment buildings. Situated to the west and extending from the central area is a large park, and surrounding the whole is a large residential area. To the east is the industrial area, separated by a green strip. Open country surrounds the city and some little distance away, a distance which is not specified, are garden cities. Two main traffic arteries running north–south and east–west cross in the centre of the group of towers. These traffic arteries are raised on concrete piles above the ground from 12 to 16 feet, and are used for passenger motor traffic. The goods traffic goes below. This idea Le Corbusier had developed as early as 1915. He visualized a whole town on two floors. The streets for pedestrians and passenger transport are on the upper floor; and goods transport, having access to the ground floors of buildings, and all the main services—water, electricity, gas, sewers, telephone—are arranged on the ground floor. This obviates the necessity of burying all these and also makes them easily accessible. This engineering scheme is the best part of the plan, and its value is clearly considerable. It has never yet been adopted.

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[1] An English translation by Frederick Etchells of the thirteenth French edition was published in 1927.

The general plan of the city has certain points of similarity with Howard's garden city clusters with a central city of 50,000 and surrounding cities of 32,000. But Le Corbusier's central city is much larger, and the garden cities clustering round are more in the nature of residential districts set in the open country. Le Corbusier's plan must obviously involve some limitation of the size of the city, because if it expanded without restriction it would join with the garden cities and much of the virtue of the plan would be lost. Le Corbusier does not indicate the limit. He altered this plan later in *La Ville radieuse*, where the garden cities are abandoned and provision is made for expansion east and west, somewhat on the lines of the lineal city.

CHAPTER XXI

Experiments in House Construction[1]

THE high costs of traditional materials, the uncertain availability of the necessary skilled labour, and the need for speed and economy prompted, in the post-war period, experiments with non-traditional materials and methods for house construction. A very large number of different methods were tried, some were good, others were indifferent. Some have been later developed, but generally very few, and even those that showed much promise were rarely consistently developed and improved. With the unprecedented demand for houses following the Second World War these methods were studied, and in some cases developed and adopted.

There were many reasons for the lack of continuous development of these new methods on anything like a big scale after the period of transition from war to peace. One was that in very few cases did they show any considerable advantages over the traditional brick house; and, other things being equal, most people generally prefer the method sanctified by tradition. Another was that when traditional materials were again plentiful at more economic prices there were unemployment problems, labour was waiting to be employed, and the provision of work was an even more urgent consideration than speed in building houses. The promise that many of these methods held was not fulfilled as it might have been, because of a lack of proper development and encouragement.

The principal advance made by the best of the new methods was in speed of construction, accomplished by the use of larger pre-cast or pre-fabricated units and by a dry method of assembly. As far as speed of erection is concerned the disadvantages of the brick house, with a pitched roof covered with tiles or slates are that it consists of a very large number of small units put together mainly by hand (several thousand such units for a small house), that a large proportion of the work is done on the site; that, because of physical exigencies in dealing with small units, the number of men who can operate on a house at once is severely restricted; that the brick house involves a wet method of assembly which can be done only in satisfactory weather, for operations must stop in frosty or very wet weather. Overcoming these disadvantages would obviously increase speed in building. This can be accomplished by the manufacture of larger components; increase of the number of men who can operate on a house at once by increasing the labour away from the site, partially by putting some of the parts together in a factory, and by a dry method of assembly so that work can proceed in all weathers throughout the year at a uniform rate. An increase of work away from the site in the factory also means greater possibilities of standardization and mass production and thus increased economy in building. Some of the new methods incorporated all these advantages, others some, while others were devised mainly with the purpose of providing alternative materials like concrete and steel, because bricks and bricklayers were not always available when and where required, and because it was considered that the alternative was cheaper. Of the methods that incorporated all or many of the advantages enumerated, the steel-framed house, with pre-cast concrete panels, the metal-clad house, and the concrete post with pre-cast concrete panel construction, are the most noteworthy. Most of these from the standpoints of resistance to moisture penetration, sound and thermal insulation, durability, and low maintenance costs were at least equal, and in some cases superior, to the traditional house built with the solid brick wall nine inches thick. The possibilities of extensive standardization and mass production in the construction of houses was imaginatively investigated at this time by Le Corbusier, and I will deal with some of his projects at the end of this chapter.

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[1] Most of the experiments were begun and developed in the period from 1919 to 1923, although many houses constructed by the resulting methods were not erected until later. There were also some experiments which belong to a slightly later date and these are included in the survey for convenience.

It is impossible to deal in detail with the numerous methods of house construction that were employed throughout Europe between 1918 and 1924: they number some hundreds; but they can all be classified under principal types, and it must suffice to indicate what these are. They may be enumerated as follows: Houses with (1) solid concrete walls; (2) concrete cavity walls built *in situ*; (3) walls built with concrete blocks, either solid or cavity; (4) concrete post and beam construction with concrete cavity panel wall construction; (5) steel frame construction with cavity walls or panels of brick, concrete, asbestos, or other suitable material; (6) metal-clad construction; and (7) timber houses.[1]

1. Houses with solid concrete walls were built in many countries. The

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[1] An excellent survey of the methods of construction used in Great Britain is given in *House Construction*, No. 1 of Post-war Building Studies, by an Interdepartmental Committee (London, 1944). There is also a good account in *Cottages, their Planning, Design and Materials*, by Sir Lawrence Weaver (London, 1926).

concrete is poured between shuttering and is faced externally and internally. One method of solid concrete wall, first developed in Holland, is the 'corolite' or 'no-fines' concrete wall. This was used in municipal housing in Amsterdam, the 'Greve' system being one example. It was first used for houses in Great Britain at Edinburgh in 1922. 'No-fines' concrete, as the name implies, is that in which no fine aggregate is used. Generally the aggregate, which is either clinker, whin-stone, gravel, or foamed slag, is passed through a three-quarter-inch mesh, and then the fine material and dust is eliminated by passing this through a three-eighths-inch screen. The compressive strength is not so great as in ordinary concrete, but is quite adequate for house construction. The wall is full of small cavities and this means that the water penetration is considerably reduced, or almost eliminated, because the water is not drawn through either vertically or horizontally by capillary attraction as in ordinary concrete. It is claimed that an 8-inch 'no-fines' concrete wall, suitably rendered and finished internally, has a resistance to moisture penetration and thermal insulation equal to an 11-inch cavity brick wall.

Another type of concrete employed at this time was 'aerated' concrete. A house of this construction was exhibited at the Wembley Empire Exhibition in 1925. The special aggregate, called 'aerocrete', which was supplied already mixed with cement, when mixed with water expanded to double its original volume, and the resulting concrete, as with 'no-fines', is permeated with cavities to the extent of 70 per cent. of the volume.

In some methods the shuttering for solid concrete walls is permanent, two which were developed in Britain are known as the 'Universal' and the 'Fidler' types. In the former the permanent shuttering consists of asbestos-cement sheets. Steel-channel stanchions at 4-foot centres and horizontal rods at 6-inch centres were erected, to which were wired the asbestos-cement sheets, thus keeping the shuttering in position. The wall is 6¾ inches thick. In the 'Fidler' method clinker concrete slabs 2½ inches thick formed the shuttering between brick quoins, and concrete was poured into the 4-inch cavity. Resistance to moisture penetration appears to have been better with the 'Fidler' than the 'Universal' type; in the latter damp penetration appears to have occurred in the shrinkage cracks of the external asbestos-cement sheets.[1]

2. The advantage of cavity walls in keeping a house dry, and in securing superior thermal and sound insulation to that afforded by the solid wall, was being increasingly realized. Thus in the majority of experiments with

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[1] Further details of these two types are given in *House Construction*, op. cit., pp. 48, 53.

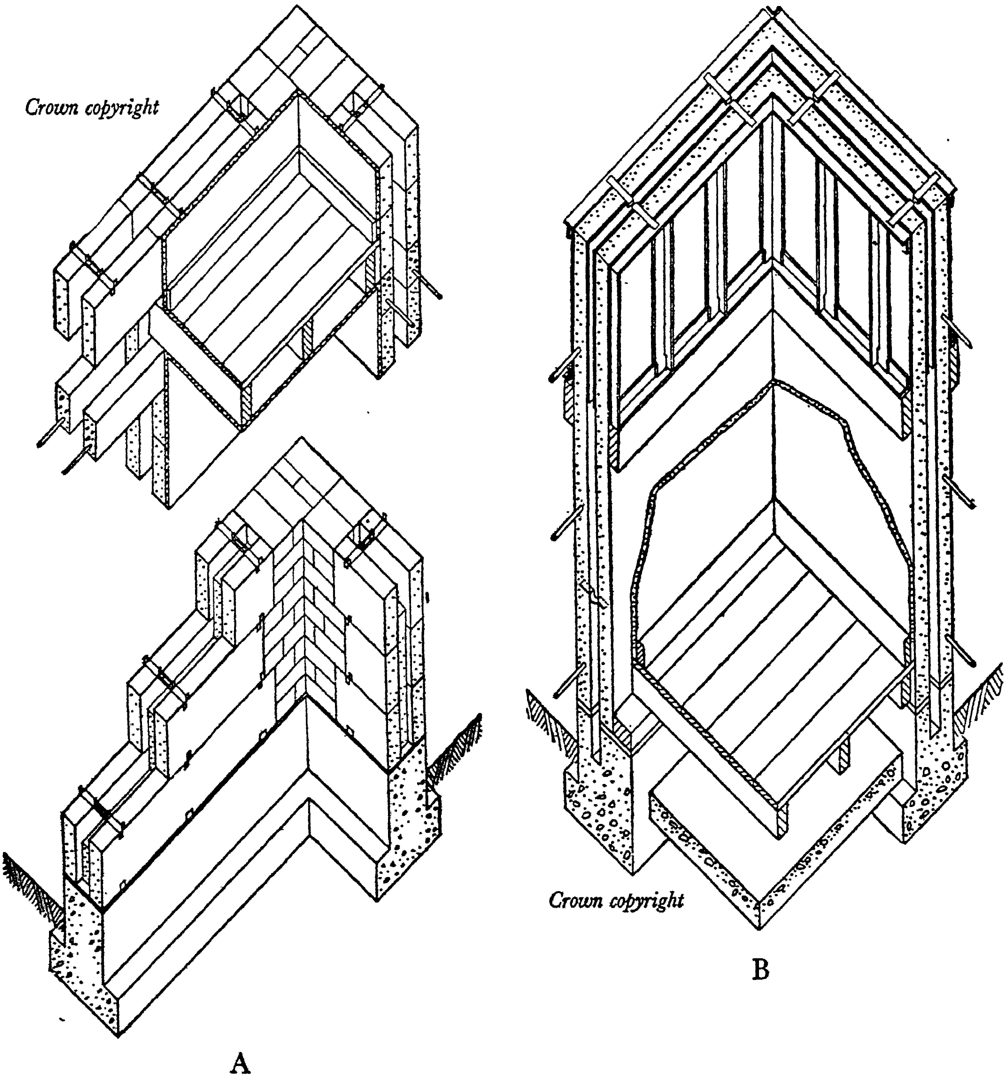


PLATE XLV

A. THE FIDLER HOUSE—CAVITY WALL OF BREEZE SLABS, HELD BY METAL CLIPS AND THE CAVITY FILLED WITH CONCRETE.

B. THE EASIFORM HOUSE (MESSRS. JOHN LAING AND SON, LTD.) CAVITY WALL OF REINFORCED CONCRETE EXTERNALLY (ROUGH-CAST) AND CLINKER CONCRETE INTERNALLY (PLASTERED). SPECIAL SYSTEM OF STEEL SHUTTERING new methods the cavity wall is employed. Walls of frame or post construction with two leaves forming a cavity were the subject of the most numerous experiments, but there are some examples of concrete cavity walls without post or frame construction, where the walls are thus supporting and the concrete is built *in situ*. The 'Easiform' system is one of the best known, and it also provides an example of the change from solid to cavity construction, as the earlier 'Easiform' houses, built shortly after the First World War, had solid walls 8 inches thick with permanent shuttering. In the 'Easiform' cavity construction both walls are 3 inches thick with a cavity of 2 inches; the external wall is of gravel concrete reinforced with horizontal steel rods, and the internal sheet is of clinker concrete. Other methods of concrete cavity wall construction are similar. The leaves are generally 3, 3½, or 4 inches thick, with a cavity of 2, 3, or 4 inches.

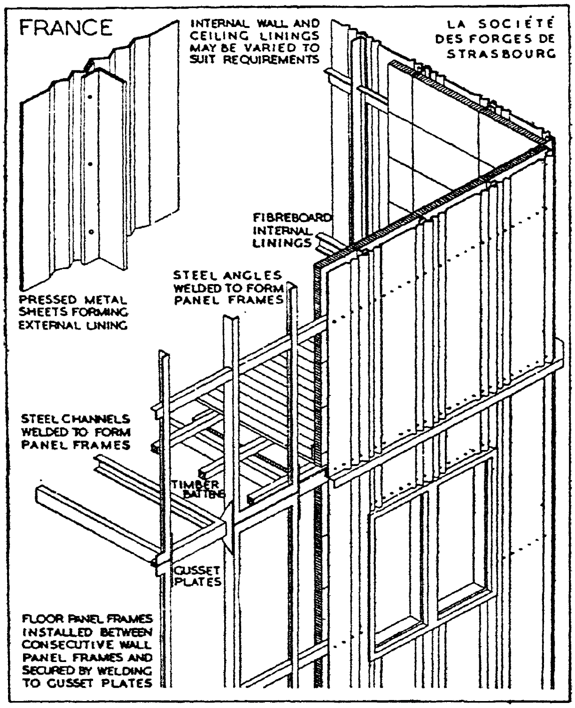
3. Walls of concrete blocks, either solid or hollow, were built chiefly with the purpose of increasing speed, as the blocks are considerably larger than bricks, and as a substitute for bricks when these were not readily available in the requisite quantities. Several houses at Watergraafsmeer in Holland were built with concrete blocks, both solid and hollow, some with solid walls and some with cavity walls. The 'Isotherme' is a system where hollow blocks are used in cavity construction. The blocks for both external and internal leaves are about 3¾ inches thick by about 11¼ inches by 6½ inches, those for the external sheet being of gravel concrete and those for the internal sheet of slag concrete. Cavity walls with solid concrete blocks were built in England during this period, the blocks being 3–4½ inches thick, and about 1 foot 6 inches by 9 inches. Stone or gravel concrete was used for the external sheet and clinker concrete for the internal sheet. Building houses with concrete blocks of this size has never become a serious rival to brick construction. It is doubtful whether it is much more rapid.

4. The concrete post and panel construction was employed with variations to a fair extent during the nineteen-twenties, and it is regrettable that it was not more energetically developed, as it promised to be one of the most efficient methods. The posts are placed at the corners, and sometimes at intervals along the walls. In some systems all the posts are of the same size and section, in others the corner posts are larger than the intermediate posts, which are therefore structurally subordinate. In the majority of variations of this type, such as the Boswell, Boot, Winget, Underdown, and Bron, the posts are reinforced, but in a few cases, such as the Duo-slab, they are not. In several systems the posts are formed *in situ* with pre-cast concrete panels fitted between and forming a cavity, as in the Duo-slab, Winget and Under-

down; but in some systems, such as the Boswell, the piers are pre-cast with the panels formed *in situ*; while in the Boot construction both the posts and panels are pre-cast. These differences are dictated by the constructional design. Some of the methods are illustrated. The Winget method (Plate XLVI A) has large concrete piers at the quoins with smaller piers between the slabs fixed at intervals of 3 feet at the joints of the wall slabs. The Boot construction (Plate XLVI B) differs a little in principle from most methods of this type in that the piers consist of two reinforced slab units of the same thickness of 3 inches as the wall leaves, separated by 2 inches and held together by ties. The virtue of this construction is that it provides a continuous cavity. In the Bron method, used at Watergraafsmeer in Holland, the concrete ribs and panels are all made into large pre-cast sections, two of which complete the side of a house. In most of these concrete houses built in England the roofs were of the usual pitched timber construction covered with tiles or slates, but in Holland and France the concrete flat roof was more usual.

5. The steel-framed house with cavity wall follows the same principle as the concrete post and panel construction, but the former shows a greater variety of method, while different materials are used for the panels and filling. One of the commonest forms of steel frame construction used for houses in the decade after the First World War is that in which the steel frame occupies the wall cavity, and the external and internal wall leaves are fixed to it. In the type designed by Dennis Poulton the upright stanchions are placed at 10 to 12 feet centres, the external leaf is brick, and the internal leaf is of anhydrate blocks plastered. In another variation of this type, called Dorlonco, designed by Dorman, Long & Co., the external leaf is composed of cement rendering on a ribbed metal lathing fixed to steel rods. The cavity is 4 inches and the inner leaf is of clinker slabs 2 inches thick. A similar kind of external leaf was employed in one system of one-story steel-framed houses in Germany. In this example rectangular steel frames one story high and 3 feet wide form the structure and both the external and internal leaves of the cavity wall consist of metal lathing with cement rendering externally and with plaster internally. The pitched roof was constructed similarly with a steel frame covered externally with galvanized sheets, while the ceiling is plaster over metal lathing (Plate XLIX). In another German system pre-cast concrete panels both for the internal and external leaves of the cavity wall fit between the vertical stanchions (Plate XLIX).

In some methods the steel frame is used with solid walls. An example is the system devised by Crane of Nottingham, in which clinker concrete slabs


FRANCE
INTERNAL WALL AND CEILING LININGS MAY BE VARIED TO SUIT REQUIREMENTS
LA SOCIÉTÉ DES FORGES DE STRASBOURG
FIBREBOARD INTERNAL LININGS
STEEL ANGLES WELDED TO FORM PANEL FRAMES
PRESSED METAL SHEETS FORMING EXTERNAL LINING
STEEL CHANNELS WELDED TO FORM PANEL FRAMES
TIMBER BATTENS
GUSSET PLATES
FLOOR PANEL FRAMES INSTALLED BETWEEN CONSECUTIVE WALL PANEL FRAMES AND SECURED BY WELDING TO GUSSET PLATES

STEEL ANGLES IN UNITS OF ABOUT 3 FT. WIDE BY ONE STORY HIGH. PANELS OF UPPER STORY ARE JOINED TO PANELS OF LOWER BY STEEL GUSSET PLATES WELDED *IN SITU.*

A SINGLE STORY CONSTRUCTION: PANEL UNITS MEASURE ABOUT 20 IN. WIDE: THE METAL SHEET COVERING IS PRESSED TO FORM UPSTANDING WELT BETWEEN NEIGHBOURING PANELS.

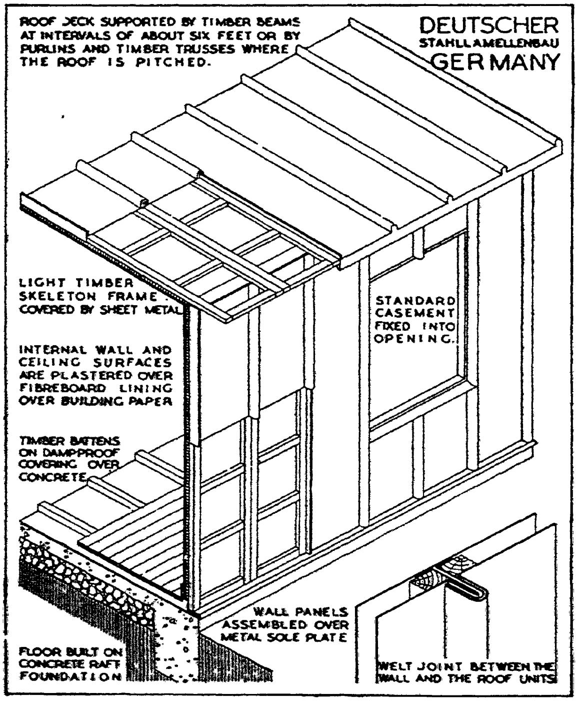
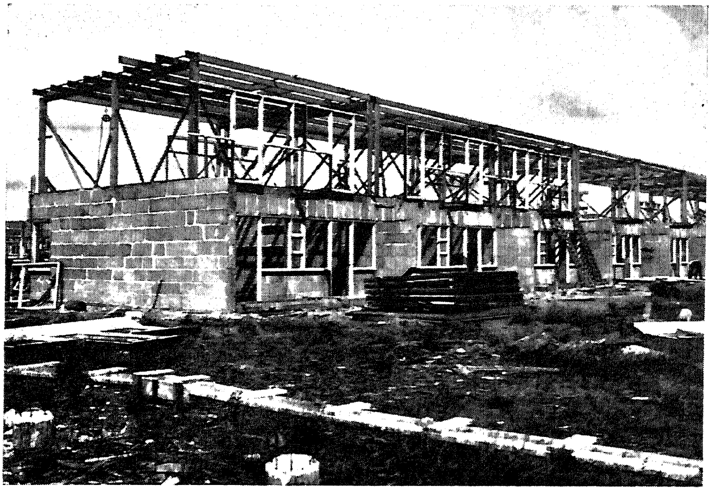
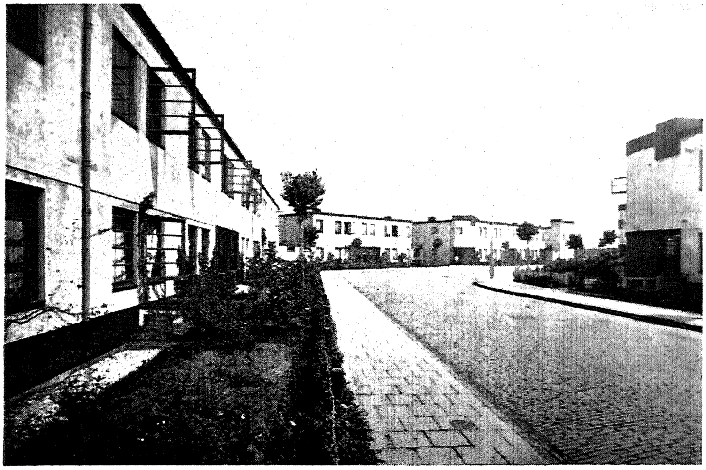

ROOF DECK SUPPORTED BY TIMBER BEAMS AT INTERVALS OF ABOUT SIX FEET OR BY PURLINS AND TIMBER TRUSSES WHERE THE ROOF IS PITCHED.
DEUTSCHER STAHLLAMELLENBAU GERMANY
LIGHT TIMBER SKELETON FRAME COVERED BY SHEET METAL
STANDARD CASEMENT FIXED INTO OPENING.
INTERNAL WALL AND CEILING SURFACES ARE PLASTERED OVER FIBREBOARD LINING OVER BUILDING PAPER
TIMBER BATTENS ON DAMPPROOF COVERING OVER CONCRETE
WALL PANELS ASSEMBLED OVER METAL SOLE PLATE
FLOOR BUILT ON CONCRETE RAFT FOUNDATION
WELT JOINT BETWEEN THE WALL AND THE ROOF UNITS

PLATE XLVII

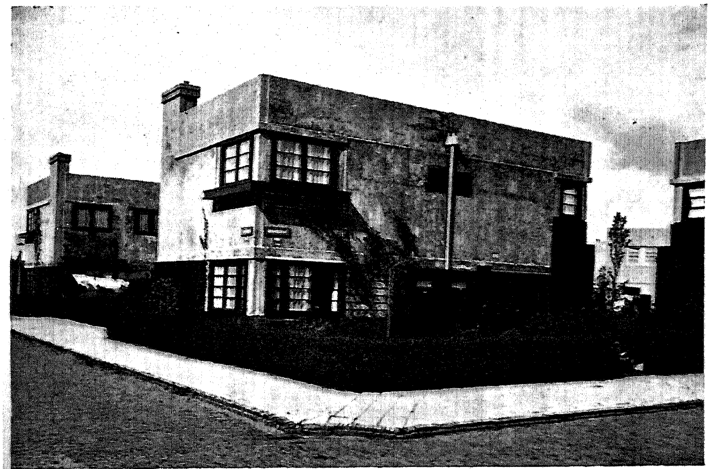
Examples of metal-clad house construction



HOUSES BUILT WITH CONCRETE BLOCKS, WATERGRAAFSMEER, AMSTERDAM, IN COURSE OF CONSTRUCTION (1924)

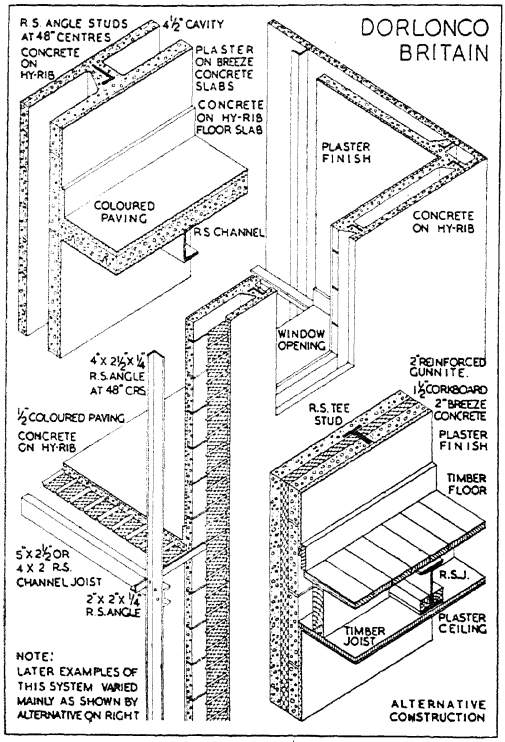


A GENERAL VIEW OF THE FINISHED HOUSES

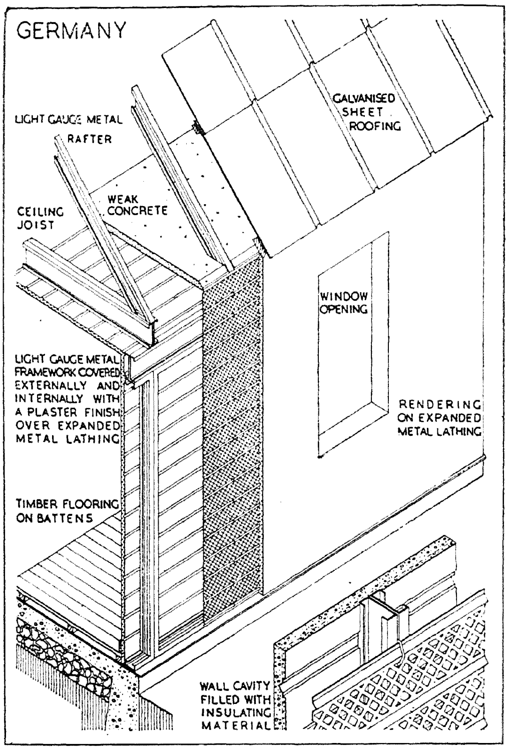


THE BRON SYSTEM USED AT THE GARDEN CITY, WATERGRAAFSMEER, HOLLAND

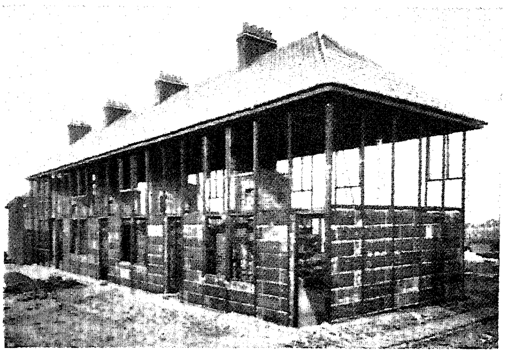
PLATE XLVIII



THE DORLONCO SYSTEM (DORMAN LONG HOUSING CO., LTD.). MAIN LOADS CARRIED BY A FRAMEWORK OF ROLLED STEEL SECTIONS IN WHICH MEMBERS ARE SPACED ABOUT 4 FT. APART TO FORM MAIN STRUCTURE. ALTERNATIVE METHODS OF CLADDING


GERMANY
LIGHT GAUGE METAL RAFTER
GALVANISED SHEET ROOFING
CEILING JOIST
WEAK CONCRETE
WINDOW OPENING
LIGHT GAUGE METAL FRAMEWORK COVERED EXTERNALLY AND INTERNALLY WITH A PLASTER FINISH OVER EXPANDED METAL LATHING
RENDERING ON EXPANDED METAL LATHING
TIMBER FLOORING ON BATTENS
WALL CAVITY FILLED WITH INSULATING MATERIAL

A GERMAN SINGLE-STORY SYSTEM. THE PANEL FRAMES COMPOSED OF LIGHT GAUGE METAL CHANNELS WELDED TOGETHER IN THE WORKSHOP IN UNITS ABOUT 3 FT. WIDE



THE PARTLY COMPLETED HOUSE

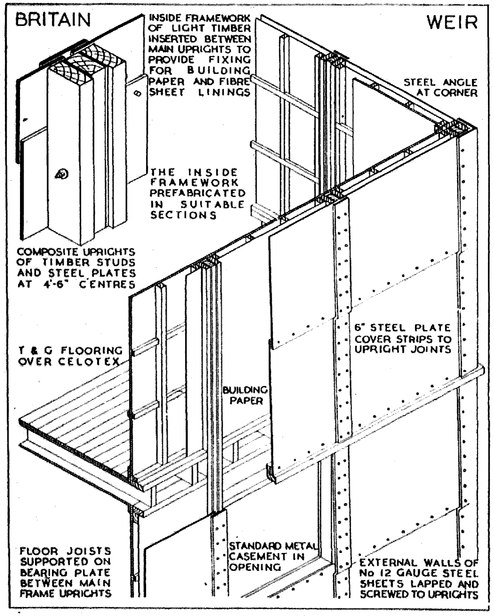
ANOTHER GERMAN SYSTEM: DOUBLE-CHANNEL STANCHIONS WITH CONCRETE-SLAB INFILLING

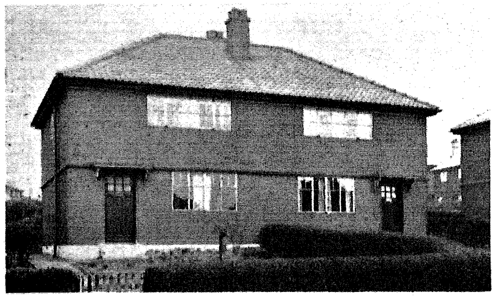
EXAMPLES OF STEEL-FRAME HOUSE CONSTRUCTION BETWEEN THE WARS

PLATE XLIX

Metal-clad house construction

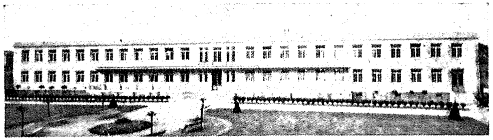
A

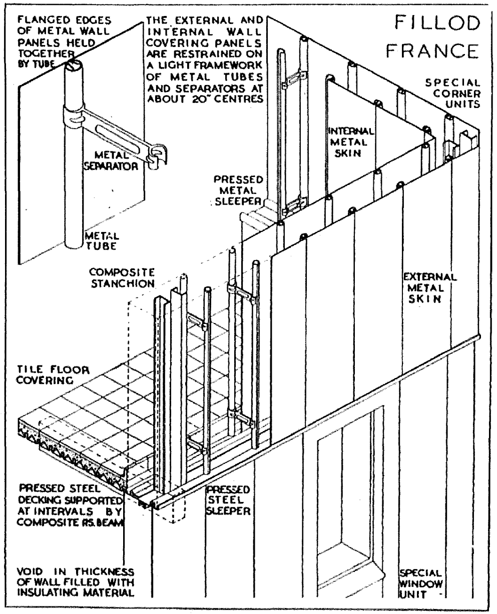

BRITAIN
WEIR
INSIDE FRAMEWORK OF LIGHT TIMBER INSERTED BETWEEN MAIN UPRIGHTS TO PROVIDE FIXING FOR BUILDING PAPER AND FIBRE SHEET LININGS
STEEL ANGLE AT CORNER
THE INSIDE FRAMEWORK PREFABRICATED IN SUITABLE SECTIONS
COMPOSITE UPRIGHTS OF TIMBER STUDS AND STEEL PLATES AT 4'-6" CENTRES
6" STEEL PLATE COVER STRIPS TO UPRIGHT JOINTS
T & G FLOORING OVER CELOTEX
BUILDING PAPER
FLOOR JOISTS SUPPORTED ON BEARING PLATE BETWEEN MAIN FRAME UPRIGHTS
STANDARD METAL CASEMENT IN OPENING
EXTERNAL WALLS OF No 12 GAUGE STEEL SHEETS LAPPED AND SCREWED TO UPRIGHTS



A. THE WEIR HOUSE. THE STEEL SHEETS ARE FIXED TO A TIMBER FRAMEWORK AND THE JOINTS ARE PROTECTED WITH STEEL COVERED STRIPS, WHILE THE INTERNAL SHEETS ARE PULPBOARD AND FIBREBOARD

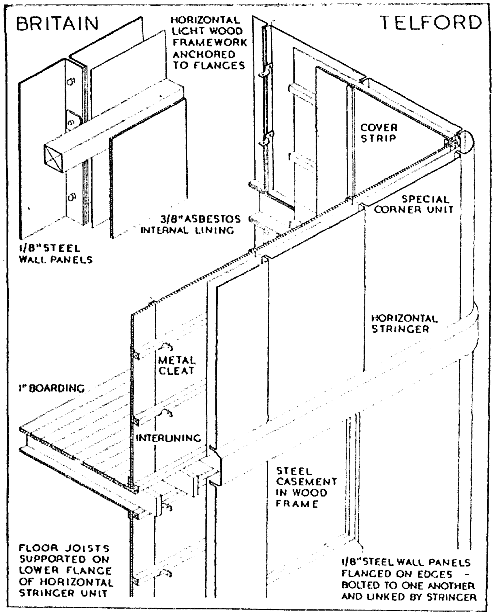
B

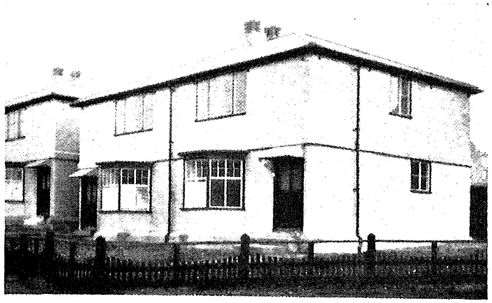



FILLOD
FRANCE
FLANGED EDGES OF METAL WALL PANELS HELD TOGETHER BY TUBE
THE EXTERNAL AND INTERNAL WALL COVERING PANELS ARE RESTRAINED ON A LIGHT FRAMEWORK OF METAL TUBES AND SEPARATORS AT ABOUT 20" CENTRES
SPECIAL CORNER UNITS
METAL SEPARATOR
INTERNAL METAL SKIN
PRESSED METAL SLEEPER
METAL TUBE
COMPOSITE STANCHION
EXTERNAL METAL SKIN
TILE FLOOR COVERING
PRESSED STEEL DECKING SUPPORTED AT INTERVALS BY COMPOSITE RS. BEAM
PRESSED STEEL SLEEPER
VOID IN THICKNESS OF WALL FILLED WITH INSULATING MATERIAL
SPECIAL WINDOW UNIT

B. THE FILLOD SYSTEM. THE TUBULAR STEEL UPRIGHTS ARE RANGED IN PAIRS CLIPPED TOGETHER BY METAL SEPARATORS. THE FLAT ROOF IS OF PRESSED STEEL DECKING FIXED TO A STEEL FRAME

C

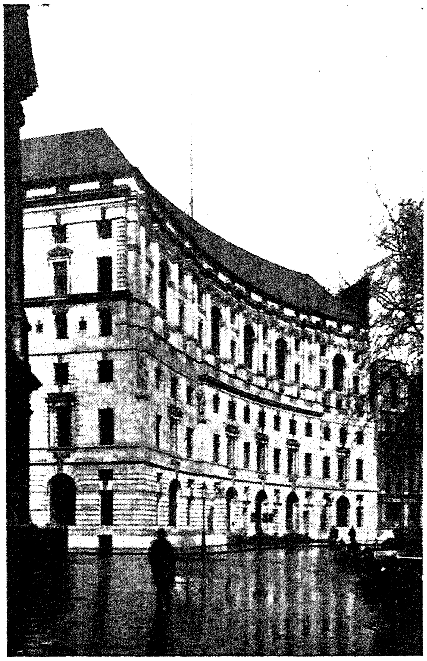

BRITAIN
TELFORD
HORIZONTAL LIGHT WOOD FRAMEWORK ANCHORED TO FLANGES
COVER STRIP
SPECIAL CORNER UNIT
3/8" ASBESTOS INTERNAL LINING
1/8" STEEL WALL PANELS
HORIZONTAL STRINGER
METAL CLEAT
1" BOARDING
INTERLINING
STEEL CASEMENT IN WOOD FRAME
FLOOR JOISTS SUPPORTED ON LOWER FLANGE OF HORIZONTAL STRINGER UNIT
1/8" STEEL WALL PANELS FLANGED ON EDGES - BOLTED TO ONE ANOTHER AND LINKED BY STRINGER



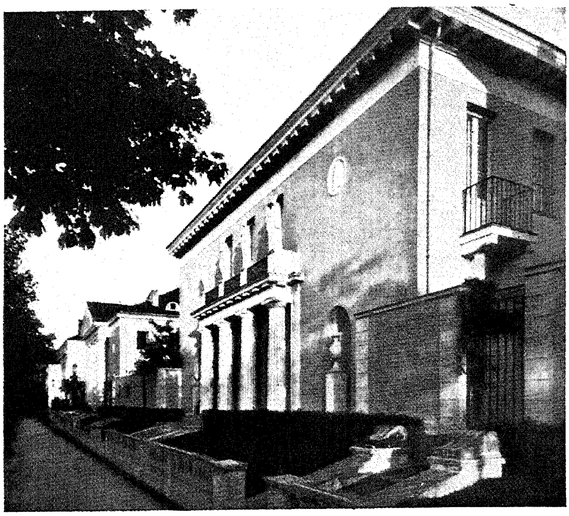
C. THE TELFORD HOUSE. THE SYSTEM CONSISTS OF STEEL PANELS WITH FLANGES AT THE EDGES PROJECTING INWARDS

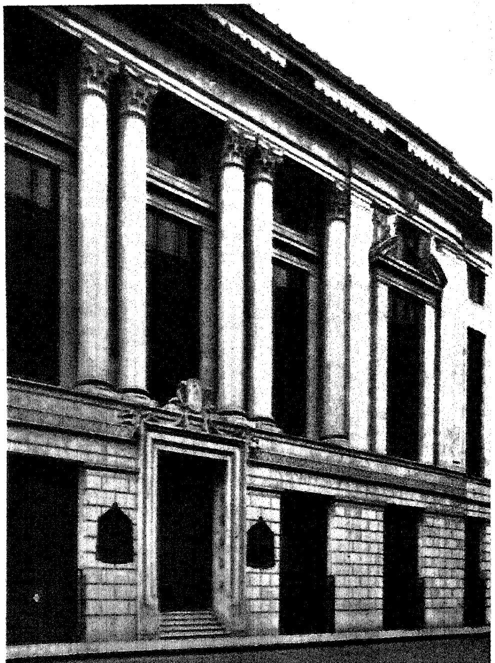
PLATE L

BRITANNIC HOUSE, FINSBURY CIRCUS
Architect: SIR EDWIN LUTYENS (1922–24)

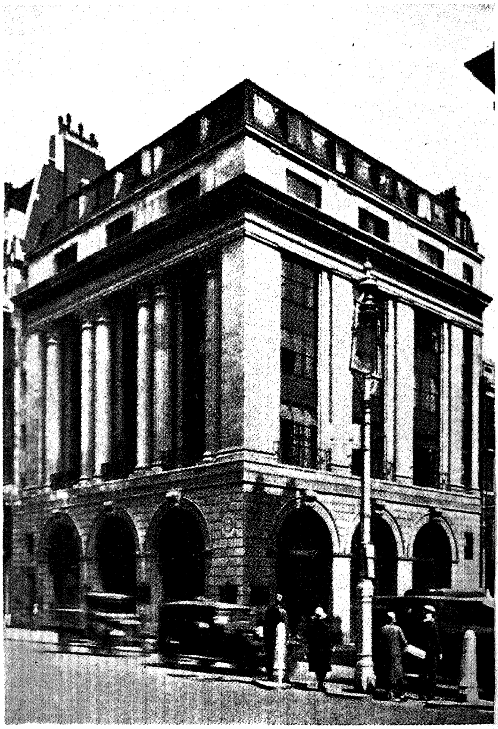


HOUSE IN BALLENSTEDTERSTRASSE, BERLIN
Architect: ALEXANDER KLEIN (1923–24)



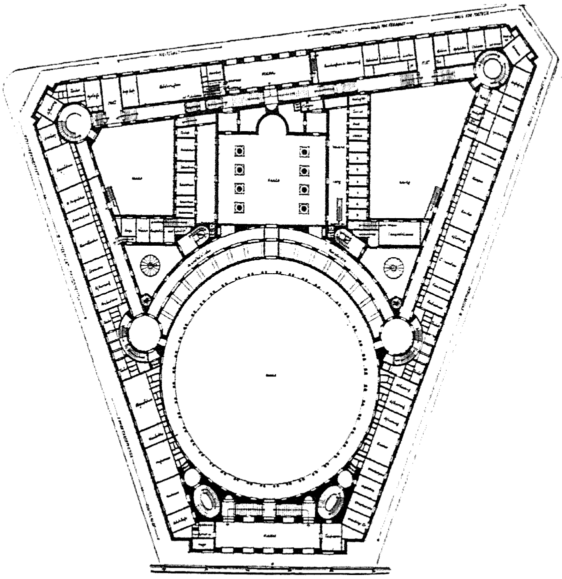


LONDON LIFE ASSURANCE BUILDING, KING WILLIAM STREET. *Architect*: W. CURTIS GREEN (1924)

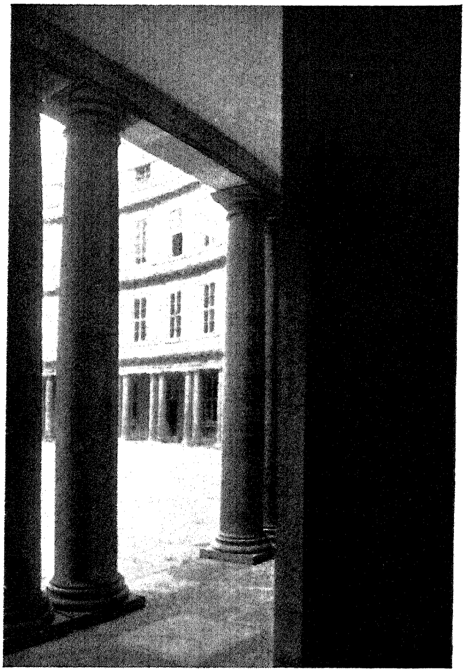


WOLSELEY BUILDING (NOW BARCLAYS BANK), PICCADILLY
Architect: W. CURTIS GREEN (1921–22)

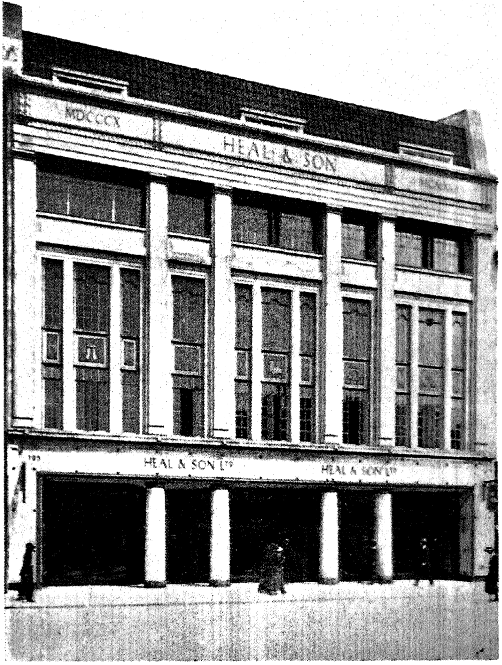
PLATE LI



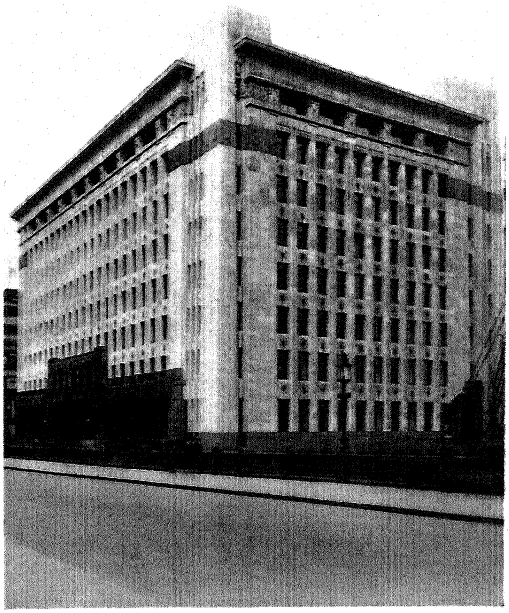
PLAN OF POLICE HEADQUARTERS, COPENHAGEN
Architect: HACK KAMPMANN (1919–23)



VIEW OF THE CIRCULAR COURTYARD OF THE POLICE HEADQUARTERS, COPENHAGEN

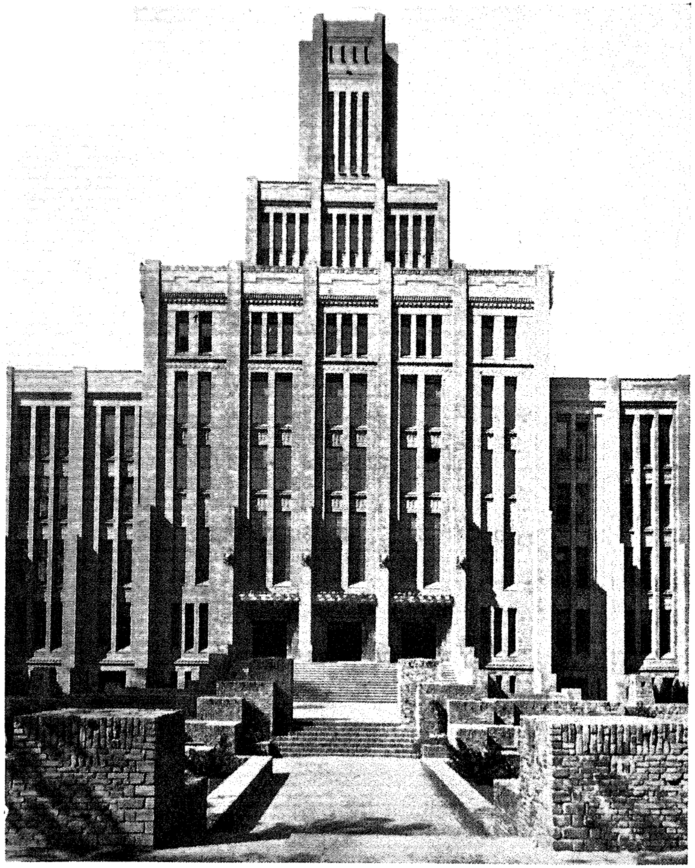


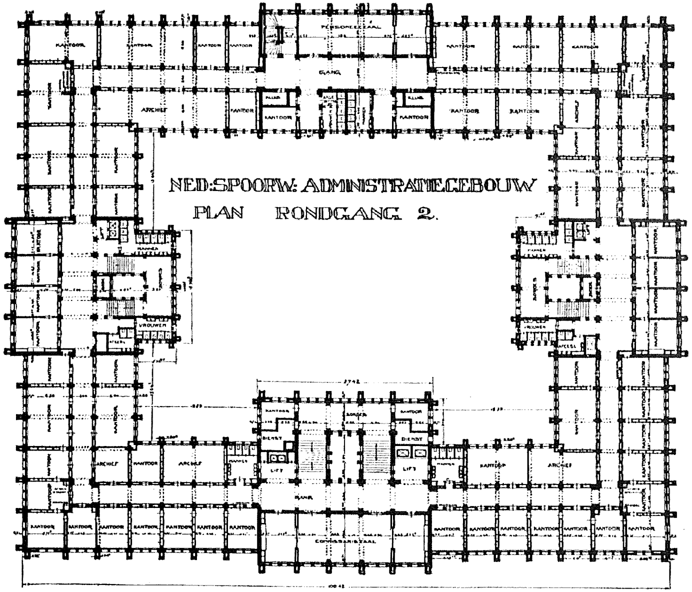
PREMISES OF HEAL AND SON, TOTTENHAM COURT ROAD
Architects: SMITH AND BREWER



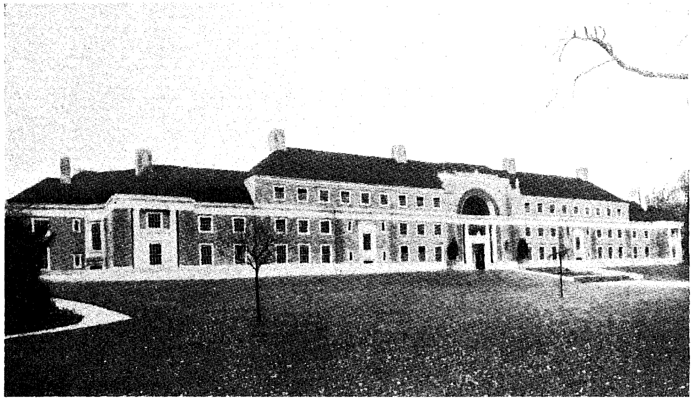
ADELAIDE HOUSE, LONDON BRIDGE
Architects: SIR JOHN BURNET AND PARTNERS (1923–24)

PLATE LII


A



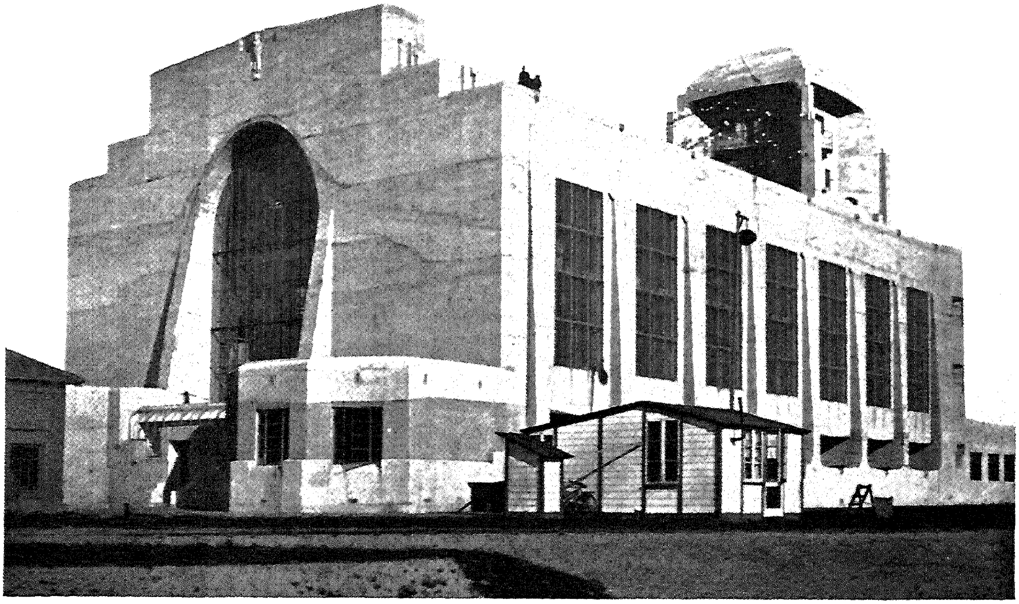
B


C

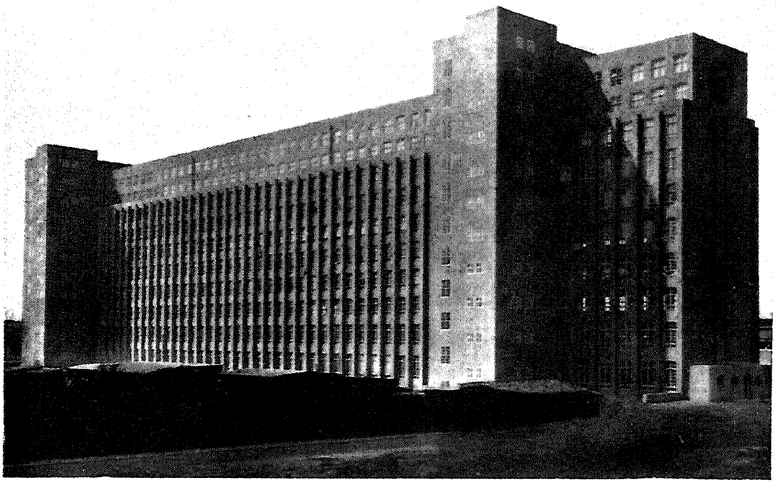
A AND B. THE FRONT VIEW AND PLAN OF OFFICE BLOCK IN UTRECHT
Architect: G. W. VAN HENKELOM (1920–22)

C. MEMORIAL BUILDINGS, CLARE COLLEGE, CAMBRIDGE (BEGUN 1922, CARRIED OUT IN SECTIONS AND COMPLETED 1934)
Architect: SIR GILES GILBERT SCOTT

PLATE LIII

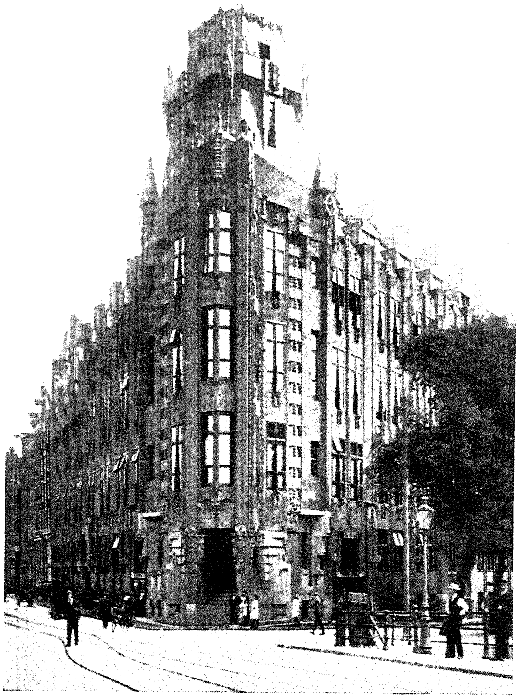


WIRELESS STATION AT KOOTWYK
Architect: W. J. LUTHMAS (1920–21)



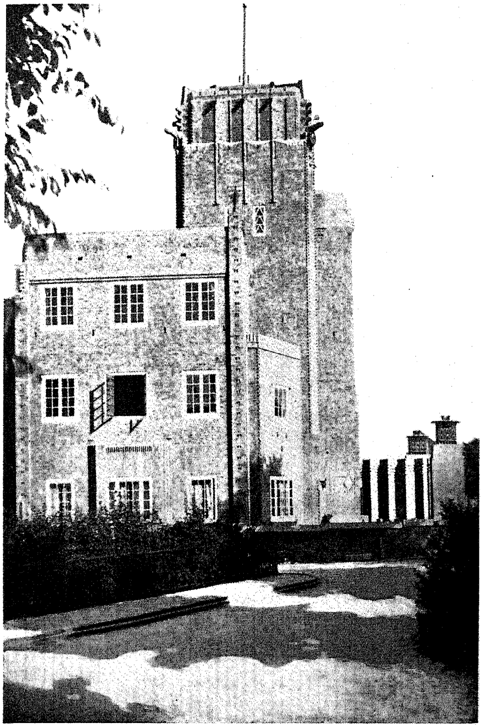
SCHALTWERK-HOCKHAUS IN SIEMENSSTADT, BERLIN
Architect: HANS HERTLEIN (1922–25)

PLATE LIV

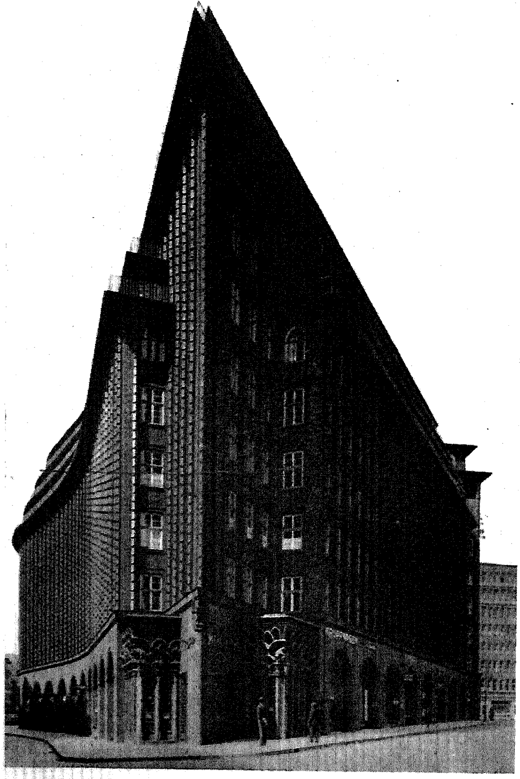


HEAD OFFICE BUILDING OF SHIPPING SOCIETIES AT AMSTERDAM (1914–16)

Architect: J. M. VAN DER MEY



OFFICES FOR FEDERATION OF SAILORS AT DEN HELDEN (1914–16) *Architect*: P. KRAMER



CHILE HOUSE, HAMBURG (1923)
Architect: FRITZ HOGER

PLATE LV

6 feet long by 1 foot by 5 inches thick fit between stanchions. In these houses, built at Nottingham, the pitched roof was constructed of steel trusses.

A somewhat novel construction is that used in the Nissen Petren system, in which a semicircular steel frame springing from ground-floor level forms the essential structure. The shape is the same as the well-known Nissen army hut. The walls up to first-floor level are of cavity concrete construction, while the roof is covered with metal sheets which curve with the frame.

Generally it may be said that the houses built of a steel frame with cavity walls represent a type of construction which is good and valuable, and which offers great possibilities for development.

6. The metal-clad house was the subject of various experiments in the post-war years, and it attracted more attention than any other type. Although the methods evolved were often ingenious it is doubtful if they offer the same possibilities for further development as concrete and steel-frame construction, for the metal-clad house has the drawback that the metal cladding does not make any very effectual contribution to thermal insulation.

In some methods steel cladding is fixed to a timber frame and in others to a steel frame. In the Weir, Conweison, and Deutsche Stahllamellenbau methods the steel sheets are fixed to a timber framework. In the two first named the joints are protected with steel cover strips, while the internal sheets are pulp-board and fibre-board. In the last named the metal sheet forms an upstanding welt at the joints. The internal lining is plaster on fibre-board. The pitched roof is constructed similarly to the walls (Plate XLVII.) In the Atholl system and that of La Société des Forges de Strasbourg the steel sheets are fixed to a steel frame. In the former the internal sheet is of fibre-board on wood fillets; in the latter steel panel frames made in the workshop are fitted together on the site and the steel cladding is fixed to these with fibre-board as internal lining. The structure of the floors and the roofs follows the same principle (Plate XLVII.) Another method consists of steel panels with flanges at the edges projecting inwards. The Telford system is an example (Plate L c), while the Thorncliffe method, in which cast iron is used, is similar. In the former the panels are 8 feet by 3 feet 6 inches with flanges 3 inches deep, and in the latter the panels are 3 feet square. The internal sheets are similar in both, consisting, in the former, of asbestos-cement on timber studs, and in the latter, of plaster-boards.

One of the most ingenious of the metal-clad constructions is the French Fillod system. The walls consist of tubular steel uprights, arranged in pairs clipped together by metal separators. These uprights are made with a slot into which are fixed the external and internal metal sheets. The joint is covered with insulating material. The flat roof is of pressed-steel decking fixed to a steel frame (Plate L B).

7. Houses of timber have been built for centuries in Russia and the Scandinavian countries, and many of these have been found to be very durable. In the post-war period timber house construction was further developed and some experimental methods were employed. They may be divided under the two main heads of framed construction, the boards being fixed to the frame, and the solid wall panel construction. In the frame construction cavity walls are usually employed, the frame being within the cavity; in the solid wall panel construction it is possible, as shown in many houses built in Sweden, to make large sections of the wall away from the site. Experiments have been made with many variations of these methods, but it is doubtful if timber can rival steel and concrete as a material for the speedy mass production of houses, because, being a natural material, and not being processed as are steel and concrete, it does not lend itself to such accurate mathematical calculations. There are some developments, however, in the application of processes to timber whereby a reliable consistency of strength may be secured which will render precise mathematical calculations possible.

As I have already mentioned, the possibilities of standardization and mass production in the speedy and economic supply of houses were appreciated in those post-war years by Le Corbusier, and are dealt with in his book *Vers une architecture*. Le Corbusier emphasizes in this book that the natural evolution of building is for it to move towards the machine, and the methods of producing the efficient machine must be applied more and more to building. The beauty of building will consequently acquire more the character of the beauty of the machine, and he cites the familiar examples of the aeroplane and motor-car. The machine is made in the factory, its construction is the subject of scientific calculation and precision, and it can be economically produced if its parts are standardized and reproduced in large numbers by machines. But for this to be accomplished it is necessary that a definite dimension should be the basis of the standardized parts, so that they should be of sizes which are multiples of this dimension, and that these parts—windows, doors, walls, roofs, staircases—should be standardized in patterns and sizes. Le Corbusier points out also that it is necessary that materials capable of precise scientific calculation should be used. This is not possible with natural materials like stone or timber, thus this modern evolution in building means 'the replacing of natural materials by artificial ones, of heterogeneous and doubtful materials by artificial ones (tried and proved in the laboratory), and by products of fixed composition. Natural materials, which are infinitely variable in composition, must be replaced by fixed ones.'[1]

Le Corbusier suggests a variety of methods for mass-produced houses, mostly on the reinforced concrete frame principle. One interesting example is what he calls the 'citrohan' house, in which the whole structure is raised on piers.[2] It is built with a concrete frame, with hollow walls with 1⅛-inch leaves of concrete and expanded metal and a 7½-inch cavity. A variation of the concrete frame, of which Le Corbusier indicates the possibilities, is the whole house just poured into a mould, 'as you would fill a bottle', the house being completed in a day.

The concrete and steel-frame construction with pre-cast panels and the metal-clad construction for houses which I have briefly reviewed held promises of more scientific, speedy, and economic methods of house construction than was possible with traditional methods consistent with economy. But, as I said at the beginning, they were not sufficiently developed, nor were houses constructed by these methods on a sufficiently large scale to encourage further progressive developments. When house production grew to considerable magnitude after 1924, a very small proportion of the houses were built by these new methods; the great majority were built of the traditional brick, with the unsatisfactory solid brick wall, where most of the labour is on the site, and where standardization, mass production, and prefabrication was limited to windows, doors, and interior fittings. The reason for this, although already indicated, must be emphasized. There was no longer the shortage of labour and materials of the period immediately following the First World War; instead, the problem of employment was important, and the question was not to save work by more scientific mass production of houses but to provide employment for a building labour which was beginning to exceed the demand. In few countries in Europe was it realized that the development of these methods did not mean less employment but more houses, which, being up-to-date, would have meant the speedier replacement of obsolete dwellings and thus a quicker improvement in the standard of living. No country in Europe had built sufficient houses by 1939 to give all its inhabitants even a reasonable standard of accommodation. And the realization that periods of economic depression, of emergency, of war, mean aggravation of the housing shortage should prompt the reflection that it is unwise to abandon progressive scientific developments for older methods. But the older methods were adopted because of conservative inhibitions, and because of the antiquated unimaginative belief that employment can only be provided by the retention of methods that require the most labour. In a properly regulated and progressive state there is always more work to do than is possible of accomplishment with the fullest programme of full employment attended by a reasonable degree of leisure, even when full advantage is taken of scientific progress. But the failure to realize this in the period between the wars is yet another example of the blindness of governments and of the majority of people they represent.

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[1] English translation of thirteenth French edition (1924) by Frederick Etchells, p. 232.

[2] Ibid., p. 241 and also *Le Corbusier et Pierre Jeanneret. Œuvre complète de 1910–1929*, first ed. 1929, fourth ed. 1946, pp. 31 and 44–47.

CHAPTER XXII

The Classical Tradition and Transition

IN briefly tracing in former chapters some of the developments of European architecture before the First World War, we have noted that the waning Gothic and Greek revivals in the latter part of the nineteenth century were accompanied by a general restless striving for originality. Some architects, incipiently Gothic in thought, searched for fresh styles to revive and went farther back to pre-Gothic styles and revived Romanesque and Byzantine architecture. We shall find later that the tendency continues, especially in ecclesiastical architecture, and that one consequence is that early Christian architecture, which is a further stage of this process, has been a considerable influence and inspiration in modern church design. A conspicuous manifestation of the striving for originality was the eclecticism which was noted in Chapter III.

The Greek revival partly gave place to what was a revival of various phases of the Renaissance, noted in Chapter II; but later, in the period immediately before and after the First World War, it became mainly a continued development of Renaissance architecture, largely in the direction of further simplicity and as a result of modifications consequent upon new methods of construction. There is some similarity in appearance between much Renaissance architecture of the seventeenth and eighteenth centuries before the Greek revival, and much Renaissance architecture in the twentieth century after the Greek revival. In the latter the influence of Greek architecture is naturally stronger, and the desire for more exact reproduction of classical details with less interpretative freedom is apparent. Also the more exclusively Greek revival was not entirely dead, because many buildings of the period immediately before and after the First World War were designed in the Greek style, as, for example, Sir Edwin Cooper's Marylebone Town Hall and Alexander Klein's large house in the Ballenstedter Strasse in Berlin (Plate LI).

Most large buildings erected in the early post-war period and designed in the classic or Renaissance style were constructed with a steel frame and faced with stone or brick. Here they are essentially different from the Renaissance buildings of the seventeenth and eighteenth centuries, but with the majority of buildings in this style erected between 1919 and 1924 that difference is not apparent in their appearance. The classical tradition persisted to some extent in most European countries after the war, but most strongly in England. In Holland and the Scandinavian countries other more native traditions were stronger; in Germany and France buildings in this tradition were to a greater extent modified by new methods of construction.

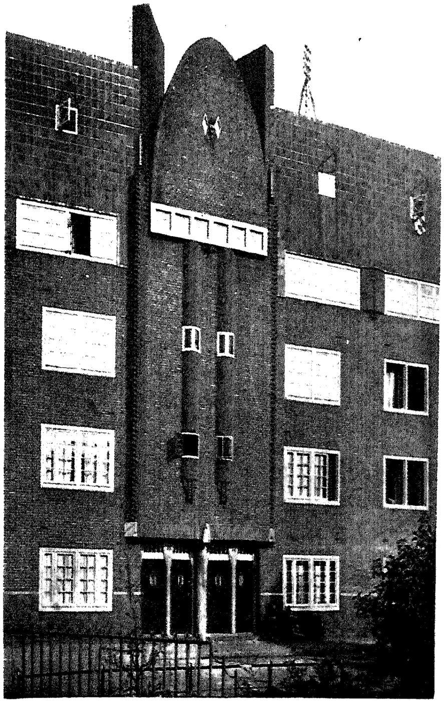
In most belligerent countries building operations, other than for war purposes, stopped during the war; while in neutral countries if they did not stop they were considerably slowed down. The types of building that were designed in the classic style were town halls, office blocks, particularly banks and insurance offices, museums, and departmental stores, and it may be said that most buildings of this kind in England and many in France, in the third decade of the century, were designed in the classical Renaissance style. Many large buildings that were conceived before the war were carried out after the war according to the original designs with little modification; and many buildings of this traditional kind that were designed soon after the war to be erected as soon as the availability of material and labour would permit, were designed very much as they would have been before the war. To such architects the war was just a break, it effected no change in their architectural thought.

If one looks at the buildings of most famous English architects and a few famous foreign architects designing in the classical Renaissance style in the decade following the war, one would not be aware that they were built with a steel frame as the essential structural feature. They appear as if built of stone or brick very much like Renaissance architecture of the seventeenth and eighteenth centuries.

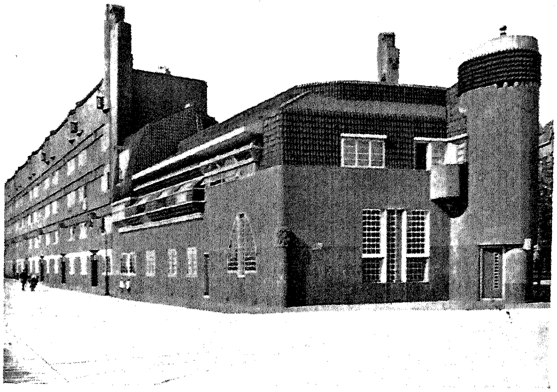
In the appearance of the Carlton Club building, and the Quadrant of Regent Street, both by Sir Reginald Blomfield; Britannic House in Finsbury Circus by Sir Edwin Lutyens; the Wolseley building (now Barclays Bank), Piccadilly, and the London Life Assurance building, King William Street, both by W. Curtis Green; or the Police Headquarters, Copenhagen, by Hack Kampmann, all of which were completed between 1919 and 1924, there is little that indicates or expresses the manner of their construction. In most, with but slight modification, there is the massive, often somewhat heavy, effect associated with the use of stone in Renaissance architecture. This is seen particularly in the buildings of Sir Reginald Blomfield and W. Curtis Green mentioned, in which there is displayed a particular affection for rusticated masonry. It was clearly the aim of these architects to perpetuate the impressive and dignified Renaissance and classic architecture of 400 to 200 years ago, and with such an aim it was impossible that they would create a vital and living art. The steel frame construction was presumably employed, not from architectural conviction, but because it allowed some reduction of bulk and because of the commercial consideration that the steel frame is a much more rapid method. At the same time it would be impossible to deny certain valuable architectural qualities in such work. Designing ability is displayed in the adaptation of the classic style to the building problem, but, as is almost inevitable with classic symmetrical elevations, one gets the impression that the designs commenced with these elevations, and the plan and interior arrangement of the building had to accord with the elevations. This was often done with considerable ingenuity. In the Police Headquarters at Copenhagen the triangular site is a little irregular, yet, as will be seen from the illustration (Plate LII), the plan is as symmetrical and formal as possible, and it is clear that the designer was thinking of the effect of his elevations, particularly of the effect of the colonnade of the circular court. It must be admitted that many of these buildings in the classical Renaissance style have considerable beauty of proportion which gives aesthetic pleasure. The proportions of the coupled columns in the recess formed to receive them on the first, second, and third floors of the two buildings by W. Curtis Green which I have cited (Plate LI) are very satisfying; in the Wolseley building the circular arches on the ground floor seem to be almost perfectly proportioned. To realize how finely proportioned is the broad simple massing of this building, which, by the way, received the R.I.B.A. Bronze Medal for street architecture in 1922, one has only to compare it with W. Curtis Green's later Westminster Bank building at the corner of Piccadilly and Albemarle Street, which has little of this grand and massive simplicity, but is cut up into comparatively unsatisfactory related parts. The Police Headquarters at Copenhagen is also noteworthy for excellent proportions and broad and impressive simplicity (Plate LII). Among some architects of this group there was a degree of originality in the treatment of Renaissance. While preserving stone or brick constructional character, Sir Edwin Lutyens often exercised a unique artistic fancy in his treatment of design combined always with an unerring sense of good proportion. In the well-proportioned Britannic House in Finsbury Circus he introduced within the general unity of the design a variety of Renaissance idioms with delightful effect, giving here and there a note of gaiety which is captivating. Here, if it is not living, expressive architecture is at least the work of architectural genius (Plate LI).

Some architects, as distinct from those already mentioned, in their treatment of Renaissance, while using steel frame construction, allowed the reduction of bulk to influence the appearance of the buildings, and some combined this with a greater degree of simplicity and allowed the plain wall to play a greater part in the design. (This latter characteristic is seen widely in Holland and the Scandinavian countries, in work that belongs rather to other traditions or only partially to the classical Renaissance, but I will deal with these in the next chapter.) This is seen in the work of Gunnar Asphund in such an example as the City Library, Stockholm, and in the secular work of Sir Giles G. Scott in examples like Clare College, Cambridge (Plate LIII c), but more particularly in the office building in Finsbury Square. It would be difficult to say if that lightness of effect in Sir Giles Scott's work of this kind is due more to a recognition that the steel frame means a much lighter building constructionally, and that this should logically have an effect on appearance, or whether it is an effect of the use of plain brick walls and avoidance of features like rusticated stonework that would give an effect of heaviness. It is probably a combination of the two. Features like window reveals, which in strictly traditional Renaissance work are kept fairly deep to give the necessary massive effect, are in Sir Giles G. Scott's early work kept almost as narrow as the steel frame will permit. In later work of this kind by this architect, as the Cambridge University Library, the steel frame is clearly expressed in the façades.

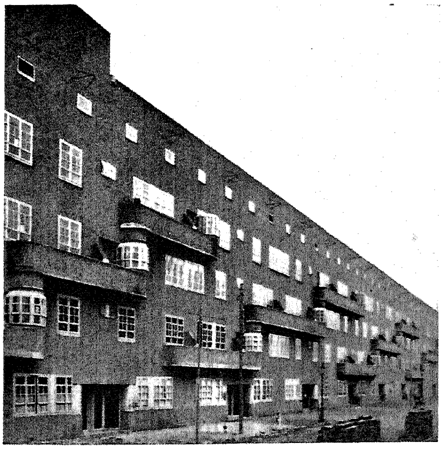
As we have seen in many industrial buildings as early as the eighteen-nineties, the steel or concrete was clearly apparent in the appearance; but in most buildings of a partially ceremonial character which were being designed in the traditional classical Renaissance style, the steel frame only very gradually affects the appearance of the building. We have noted that an early example of this kind where the steel frame has clearly influenced the design of the façade is Alfred Messel's Wertheim store in Berlin, built in 1896. There were a few others before the First World War, some of which we have noted, among them Kodak House in Kingsway built in 1911. It appears by slow degrees in buildings that are conceived more academically and the steel frame gradually asserts itself in the elevations, until in many façades it determines the essential character. We note the stages: (1) where it is faintly apparent; (2) where it becomes more assertive; and (3) where, although the building is designed on the classical principles of symmetry and formal arrangement, the decorative character of the façades emanates mainly from the steel frame, or in some cases the reinforced concrete frame, although this was not used to so great an extent for such buildings until later. The transition is accompanied by elimination of ornament and a greater simplicity in the general effect. The movement



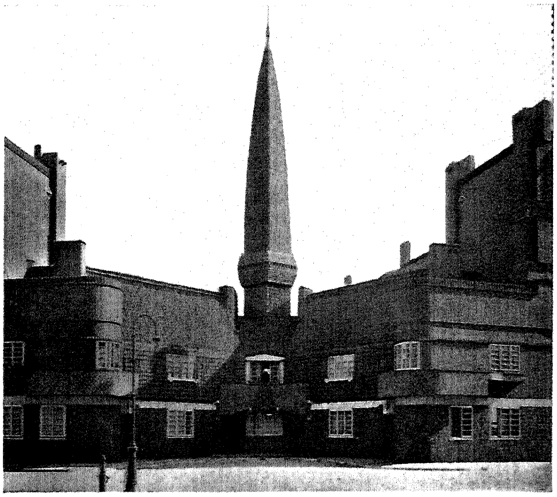
FRONT VIEW OF TENEMENT BLOCK AT AMSTERDAM
Architect: L. DE KLERK (1917)



ANOTHER VIEW OF THE SAME BLOCK SHOWING THE POST OFFICE LYING AT THE END OF THE TWO PARALLEL BLOCKS. (THE PRINCIPAL ENTRANCE IS IN THE CIRCULAR TOWER)

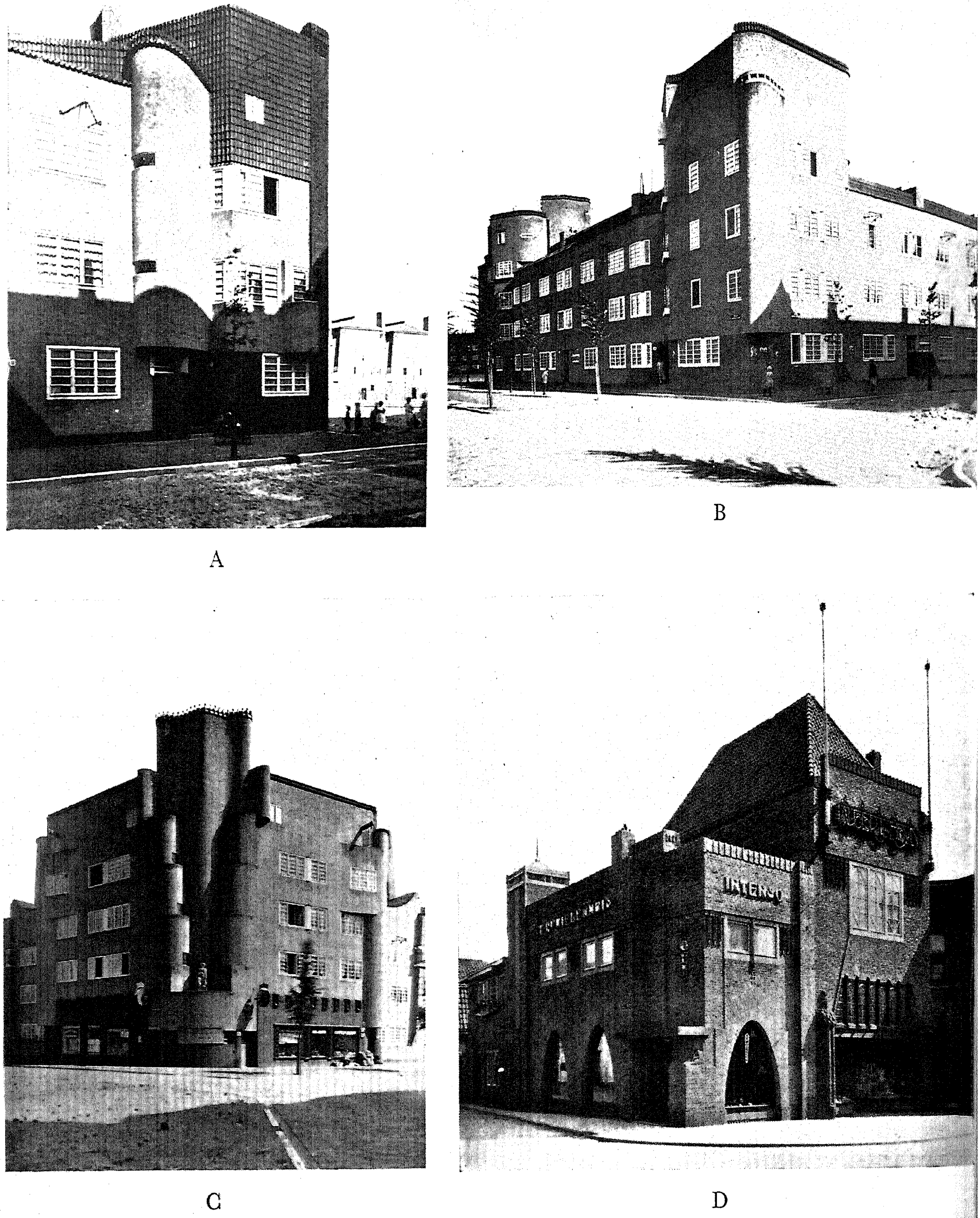


A LATER EXAMPLE OF THE WORK OF L. DE KLERK
A BLOCK OF FLATS BUILT IN AMSTERDAM
(1921–22)



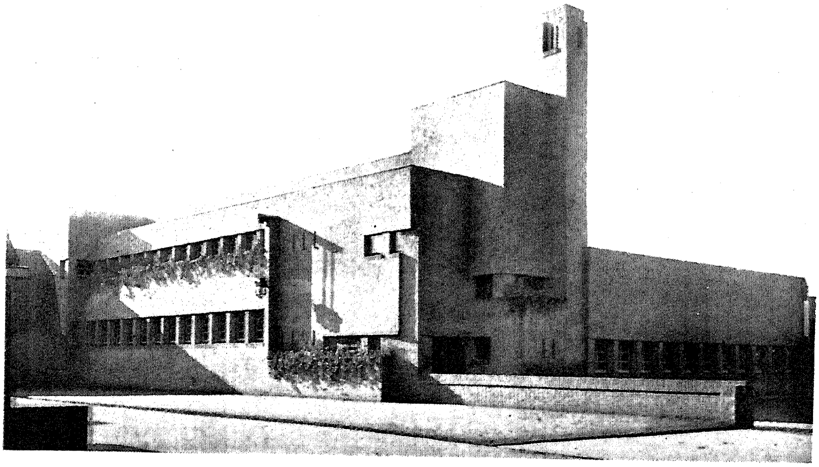
A GROUP OF TENEMENT BLOCKS ALSO BY DE KLERK, COMPLETED IN 1920

PLATE LVI



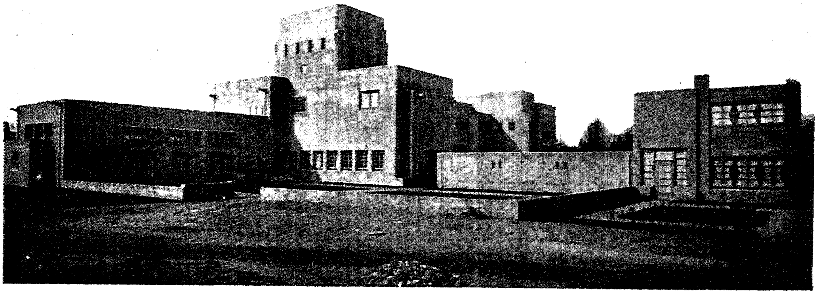
A, B, AND C. THREE VIEWS OF TENEMENT HOUSES BELONGING TO THE PUBLIC UTILITY SOCIETY AT AMSTERDAM AND ERECTED IN 1922–23. *Architect*: P. KRAMER
D. SHOP AT HILVERSUM. *Architect*: J. VAN LAREN (1922–23)

PLATE LVII



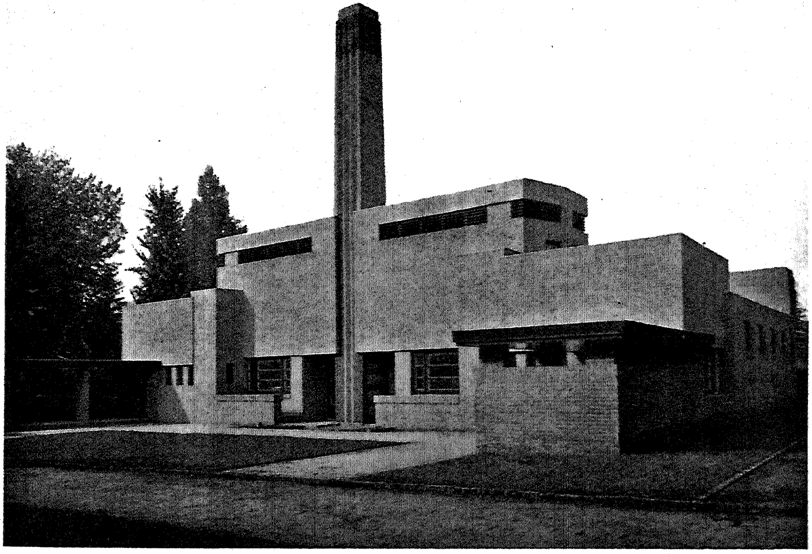
SCHOOL PREMISES AT HILVERSUM

Architect: W. M. DUDOK (1923)



ANOTHER SCHOOL AT HILVERSUM

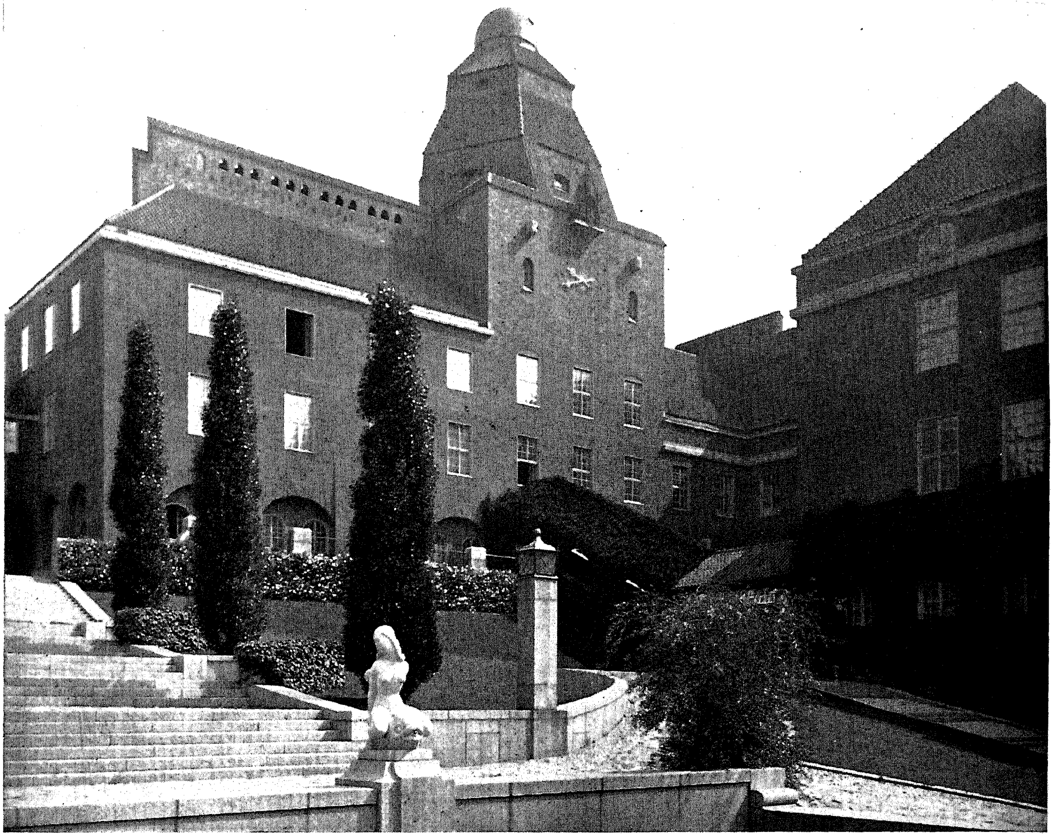
Architect: W. M. DUDOK (1923)



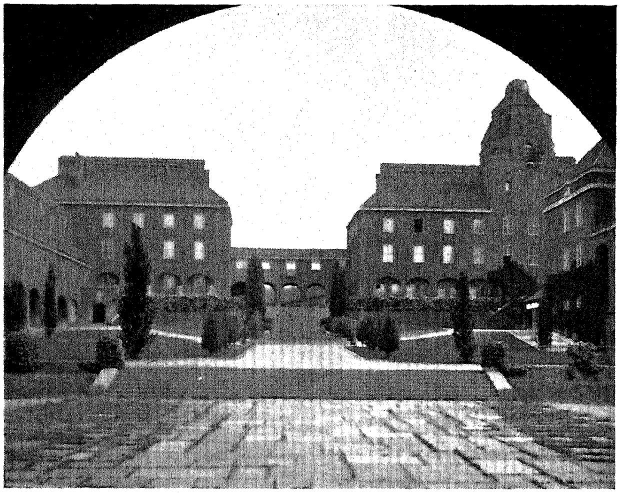
PUBLIC BATHS AT HILVERSUM

Architect: W. M. DUDOK (1924)

PLATE LVIII



A CLOSE-UP VIEW OF THE MAIN GROUP OF BUILDINGS



A GENERAL VIEW OF THE UNIVERSITY FROM THE ENTRANCE TO THE COURTS

THE UNIVERSITY OF TECHNOLOGY, BUILT BETWEEN 1914 AND 1922. *Architect*: ERIC LALLERSTEDT

PLATE LIX

towards simplicity and expression of construction are contemporary developments; it cannot be said that either causes the other, although it is probable that the negative process of eliminating ornament and thus, as it were, preparing a clean sheet for expression, is very much a condition of the movement. The transition can be studied in numerous examples of buildings erected during the six years from 1919 to 1924. In the first stage pilasters that form a prominent decorative feature of the façade became simpler, the bases and capitals are either more simply treated than in the traditional classical, or some simple ornament or moulding substituted. The spaces between pilasters are often increased, and bronze horizontal bands sometimes appear between the windows in the recesses formed by the pilasters. Examples of this kind are Heals's in Tottenham Court Road, designed by Smith and Brewer, the Blackburn Assurance Co. building in Liverpool, and Waterloo Station. The simplified treatment in each case is mainly the result of the influence of structure. In a building like Devonshire House in Piccadilly, designed by Sir Charles Reilly and Thomas Hasting, the steel frame is less apparent in the façade pattern, but there is a feeling of it in the comparatively thin walls, conspicuous in the narrow window reveals, and also in the large showroom windows on the ground floor. Belonging to this initial stage of transition is the impressive railway station at Stuttgart, designed by Paul Bonatz and F. E. Scholer, which, though classical in conception, is modified in design by the frame construction.

A second stage is where these decorated uprights have ceased to be pilasters, and where the horizontal stanchions also become apparent, with the result that the gridiron pattern seen often in factories forms a decorative basis for the façade. An excellent example of this is Adelaide House, London Bridge, designed by Sir John Burnet and Partners. The more complete transition is when all Renaissance and classical ornamental features have disappeared and the design, although determined by classical symmetry and proportion, is partially an expression of the method of frame construction. We find this in the large office block in Utrecht (Plate LIII A and B), designed by G. W. van Heukelom. It will be seen from the plan and elevation that the conception is symmetrical and formal, but the particular character of the façade, with the long, vertical, straight shafts and the subordinate horizontal members make the complete transition from a façade of classical pilasters to long, straight members that reproduce the forms of the steel frame. Another Dutch building where classical conception determines design, yet where modern structure is expressed, is the Wireless Station at Kootwyk, designed by J. M. Luthmas. It is not difficult to see in this

(Plate LIV) a transformed Greek temple, where instead of a comparatively heavy stone construction it has a lightness of aspect, seen especially in the treatment of windows, made possible by steel.

Industrial buildings offer the most modern examples. These, it must be remembered, are distinct from the more functional and progressive type of building where expression of purpose and structure makes it a more living architecture than this academic classical work. The industrial buildings with which we are at present concerned are conceived in this traditional classical spirit where formal and symmetrical plans and elevations are a law never to be broken. They are interesting as examples of this transition from classic decoration of façades to those determined by steel-framed construction. Among the noteworthy examples are the Wallace Scott Tailoring Institute, Cathcart, near Glasgow, designed by Sir John Burnett, Son and Dick; the Gros Grosskraftwerk, Klingerberg, in Berlin, designed by G. and W. Klingerberg and W. Israel; and the massive and impressive Schaltwerk-Hockhaus in Siemensstadt, Berlin, designed by Hans Hertlein (Plate LIV). In the last-mentioned the long verticals seem to be added to the façade as if to give the necessary emphasis to the steel frame.

This vertical emphasis by means of long vertical pilasters or shafts in such buildings as the office block at Utrecht (Plate LIII A and B) and many others which were designed at this time, is probably in many cases only partly prompted by the steel frame. Vertical emphasis, like horizontal emphasis, an early example of which is the office building at Breslau, designed by Hans Poelzig (Plate XXXIX), is partially due to the emphasis of the character of the building. With a long vertical rectangle there is a natural inclination to emphasize its verticality, and the same with the horizontal rectangle. Buildings were becoming simpler and larger; they were being built higher, and the influence of the vertical emphasis of soaring American buildings was being felt in Europe. In London new buildings rose to a height of 100 feet, which often meant a shape vertical in character, and simple decorative effect meant emphasis of this vertical character. In the case of a long block its length was often emphasized by unbroken horizontal bands, as was often the case in Germany at this time, or it was punctuated with vertical bands, which can hardly be said to be vertical emphasis, but a character transferred from the emphasis of vertical shape, or as articulation of the horizontal mass.

CHAPTER XXIII

Tradition, Romanticism, Simplicity, and Originality

WE considered in the last chapter the work of architects who were content mainly to design in the accepted traditional classical or Renaissance manner, a way in which there had been little change in principle since the days of ancient Greece and Rome. The constructional changes made possible by modern industry and demanded by the urgencies of commercial life were often completely concealed, but, as we noted, they began to affect the design and appearance of buildings in the classical tradition in a small but increasing degree. When an architect felt a lack of artistic integrity in expressionally ignoring the bones of his structure, that was often a first step in allowing structure to affect the appearance of his building.

Twentieth-century architects designing fairly closely within the classical or Renaissance tradition have the type of mind that finds justification in doing a thing in a certain way because it has been done in that way by great cultures and peoples in the past and has received the sanction of generations. To them, although methods of construction and needs change, and new types of building are required, these classical principles of design remain. These architects are far less interested in original and personal expression than in conforming worthily to old and venerated standards and principles which, having served the past well, will serve us too. They are the conservatives of life.

Artists, on the other hand, who are anxious to assert their own personalities, strive for originality. They are generally forceful individuals who would be discontented with merely following what others have done, not only because it is discomfiting to their own egos, but because they rightly consider that change in life demands a response in expression.

In architecture originality has many sources on which it can feed, but it is generally limited by historical and practical conditions, and, to a partial extent, by prevailing taste. In the restless period of transition from about 1908 to 1924 original architects were still conscious of the deadening influence of the classical and Gothic revivals, but by this time there were many ways in which originality could be successfully stimulated and meet with some degree of acceptance. Especially was this so in non-belligerent countries like Holland and Scandinavia generally where architectural evolution did not suffer the same break or pause as in most of the rest of Europe. The ways in which originality appeared to be stimulated during this period were by a search for ideas, forms, and decorations in the remote past; by further research into natural forms; by a use of rhythm suggested by other arts like music, of which *L'Art Nouveau* was a partial manifestation; by the suggestion of dynamicism in the new building material—steel; and by reasoning on contemporary building needs, the purpose of buildings, methods of construction, and the logical emergence of design from these, consistent with beauty. In retrospect it appears that the last was the true progressive road, and this will claim a later chapter. The most pregnant of the other sources appears to have been the search for ideas, forms, and decorations in the remote past, combined with the free exercise of individual fancy in their application.

As already implied, the countries in which work of this original and romantic type was found to the greatest extent during this period (1908–24) were Holland and the Scandinavian countries, where building during the war, although greatly reduced, did not cease, and revival after the war was rather a swell of activity than a re-starting as with the belligerents. This is one of the reasons why some of the most interesting architecture immediately after the First World War is found in these countries. Another reason is that although small they are among the most socially progressive countries in the world, and this is generally a healthy background for artistic expression.

In Chapter VI I referred to some of the architecture in Holland and Sweden as indicative of the movement towards simplicity. This is continued with rare distinction in the work of W. M. Dudok in Holland and Eric Lallerstedt in Sweden; but in taking up the story the romantic strains must claim first attention. In Holland during the present century a strong romantic affection for the native material brick is manifest. It was P. J. H. Cuypers who, during the latter part of the nineteenth century, brought 'the brick out from behind the plaster facing again', to use the words of J. P. Mieras.[1] In Amsterdam and neighbouring areas, especially Hilversum, this triumphed over all expression of the new materials and methods of construction. Rotterdam and its vicinity, where J. J. P. Oud was the great architectural exponent and influence, offers something of a contrast, for here we find building belonging more to the new architecture. But, dissimilar as is the work of M. de Klerk and W. M. Dudok, they show the same romantic affection for brick as a building and decorative material.

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[1] *Dutch Architecture of the 20th Century*, by J. P. Mieras and F. R. Yerbury (London, 1926), p. vi.

A noteworthy Amsterdam building in which is vividly expressed these romantic tendencies is the Head Office building of Shipping Societies, designed in 1914–16 by J. M. Van der Mey with the assistance of M. de Klerk and P. Kramer (Plate LI). The construction is of reinforced concrete, yet its very elaborate brick clothing with terra-cotta and concrete ornament has no marked relation to its structure. Much has been written about this building, and many explanations of its supposedly irrational character have been attempted. One is the architects' feeling that as it was impossible to express structure in the exterior brick clothing, one might as well be thoroughly romantic and pictorial and give full play to artistic fancy. On either side of the entrance are the symbolic figures of the Indian and Atlantic Oceans, and on other parts of the building are objects connected with ships, like ropes, cables, cordage, and cork jackets. The signs of the Zodiac are included, while the patterning of tiles in an entrance gable is suggestive of the ripple of the sea. Motifs of this kind form a profuse decoration of the building,[1] but it must be acknowledged that the building does not appear overloaded with ornament; it is all kept within the broad embracing lines of the façades, the general design of which has a clear vertical emphasis which might be regarded as remotely indicative of the concrete frame beneath.

It is tempting to add to the speculations on what prompted the architects to apply this profusion of symbolical and pictorial ornament. The reply to the question seems fairly simple. Such sculptured and ornamented embellishment has often been a conspicuous characteristic of the great architecture of the past, particularly of Greek and Roman temples and of Gothic cathedrals. The architects of this building have done very much the same. Just as the Gothic architects used the subjects and symbols of their religion so these architects have used the subjects and symbols of the sea and ships, and they have made full use of the motifs that the subject supplied. The value of the building as architectural expression is that instead of copying the works of the classical and Gothic architects, and using the forms and decorations they evolved, Van der Mey and his assistants have taken a subject of to-day suggested by the purpose of the building. In this way it is living and expressive architecture. But there is failure to achieve anything like the beauty of Greek or Gothic architecture because the sculptured ornament is not so well related to structure and general form.

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[1] In an article entitled 'The Rococo of To-day' in *The Architectural Review* of Aug. 1921, Halsey Ricardo, who mistakenly speaks of this building as an hotel, gives an enthusiastic description of the ornament.

About the same time (1914–16) as this Shipping Societies' building was being erected, P. Kramer, who had assisted Van der Mey, was working on the building for the Federation of Sailors at Den Helden (Plate LV). This building offers a mild contrast. Instead of the surface of the façade being fully enriched with mouldings, figures, and ornament, the effect is of plain, brick wall surfaces and of masses pleasantly related. Yet there are characteristics which betray something of the same spirit. In the top of the tower the decorative features are derived from ships, one detail being treated like a Gothic gargoyle, while in the ornate brickwork of the entrance there is again a patterning which fancy suggests might have been prompted by the sea.

Many young architects immediately before, during, and after the First World War were given opportunities for architectural expression by the enterprising Director of Housing in Amsterdam, Aerie Keppler. During these years an extensive housing scheme was in operation and a very large number of tenement blocks were built by the Public Utility Society. Architects were given some freedom, and there seems to have been a monetary allowance for that extra which could give the buildings some architectural distinction. This is a refreshing exception to the general rule for buildings of this type. Among the architects were M. de Klerk, P. Kramer, G. J. Rutgens, J. F. Staal, and H. Th. Wiydeveld. The first two seem to have been the most fanciful and original. The earlier blocks of M. de Klerk, designed between 1913 and 1918, are more fanciful and exuberant than the later blocks, designed between 1919 and 1923. Most are of four or five stories and are generally of some length which gives considerable scope for fine architectural treatment. The top floor in the mansard roof in most of the blocks is utilized as storage space, and this explains the treatment of the upper part of the façade, which often has a finish of black tiles and small windows, with crane and pulley above for the haulage of goods.

In one of the earlier blocks of de Klerk[1] the intervals where the entrances, staircases, and lifts appear are marked by a fanciful external treatment consisting of a vertical mass with a parabolic top between chimney shafts (Plate LVI). In another, a little later (1917–18), the decorative element consists chiefly of undulations on the tiled surface of the top story and turrets, and the terminations of the blocks, but here the most fanciful treatment is found in the Post Office, which lies at the end of the two parallel blocks (Plate LVI). The principal entrance is in a circular tower, with a waved tiled frieze, while the square windows are varied by two windows and an end door with parabolic arches flattened at the top. The varying wall surface of this Post Office is interesting. At the base the bricks are laid vertically; higher they are laid horizontally, and above this, covering the mansard roof, are black tiles. But the most adventurous and fanciful of all de Klerk's groups of tenement blocks is that designed in 1917, but not actually completed until 1920, in which a space between two five-story blocks with turreted ends approaching each other, as it were, at a slight angle, is treated by carrying the buildings inwards at the reduced height of two stories, and placing a delightfully picturesque spire at the point where they meet and forming a little triangular nook in the roadway. This spire serves no ultilitarian purpose, it is just a delightful indication of the Dutch love of the picturesque.

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[1] There is an interesting article by Howard Robertson on de Klerk's tenement blocks in *The Architectural Review* for Aug. 1922. The article is entitled 'Modern Dutch Architecture'. See also Howard Robertson's article with the same title in *The Architectural Review* for Sept. 1923, which deals also with the work of Kramer and Dudok.

De Klerk's later work shows a tendency to become simpler and the plain wall surface begins to play a bigger part, yet the ingenious and fanciful designer is still apparent. In the block built in 1921–2 (Plate LVI) the manner in which the balconies of the three stories are connected by jam-pot windows gives a dynamic effect of somewhat restless quality to the façade. These tenement blocks by de Klerk represent a considerable achievement for a young architect. It would have been interesting to see how this talent would have developed later, but in 1923 de Klerk died at the early age of 39.

Some of the housing work of P. Kramer has the same fanciful character, but here again there is a strong tendency to greater simplicity in later work. In the housing block called 'De Dageraad', erected in 1921, a conspicuously decorative motif is the round turrets over entrances, and in one corner treatment, in which shops appear on the ground floor, a series of rolls gives a somewhat bizarre, yet agreeably picturesque effect. It is not only this picturesque element but the kind of picturesqueness—broad, round surfaces and slight undulations, somewhat like the plain dresses of the buxom Dutch women, that makes them so typical of their country (Plate LVI).

Much other Dutch architecture of this time has a similar picturesque and fanciful quality, the work of J. van Laren, of which the shop at Hilversum (Plate LVI) is typical, is noteworthy in this respect. Some of the architecture in Hamburg at this time manifests a similar romantic quality in which brick is the prominent material, suggesting the influence of contemporary Dutch work. In the Chile House, built by Fritz Hoger in 1923 (Plate LV), there is the same romantic feeling, but there are obvious differences. There is even a partially barbaric feeling in the somewhat crude treatment of the decoration on the ground floor derived from Gothic sources, while the decoration of the upper part of the façades is in the nature of an all-over pattern rare in Dutch work.

To turn from the work of M. de Klerk and P. Kramer to that of W. M. Dudok, who was engaged since 1917 on a considerable amount of building in Hilversum, is to experience what on a first impression is a marked contrast. The buildings of de Klerk and Kramer are decorated with fanciful forms. These forms are generally ornamental embellishments which have some relation to the internal organization of the building, or to its structure. But none of this fanciful decorative embellishment appears in the contemporary buildings of Dudok. Instead the exterior beauty of his buildings depends on plain walls and the texture and colour of the brick surface, and on the relations of the plain walls and masses that compose the buildings. The differences are thus obvious enough, but on further reflection the similarities become more apparent. The same romantic affection for the traditional material brick is hardly a similarity in design, but the varieties of surface treatment, the adherence to appearances which are generally structurally possible in brick, although steel and concrete is occasionally used in the construction, a liking for horizontal emphasis broken here and there by dramatically placed verticals are qualities shared by both. While showing much of the romanticism of de Klerk and Kramer, Dudok was clearly influenced by the work of Berlage and de Bazel, with its greater simplicity and closer relations of form and structure, where the appearance of the building is expressive of its purpose and interior organization.

Hilversum is a small modern town about fifteen miles south-east of Amsterdam. Development began just before the First World War, and it was then that Dudok began designing buildings for the town, of which he has been the principal architect ever since. Buildings erected in this early period, and completed in the five years following the war were public baths, two schools, an abattoir, an electric draining mill, and some houses (Plate LVIII). One of the earliest, the public baths, is symmetrical in design, but this symmetry is rarely followed in later work. In his schools there are no *a priori* considerations of this kind, the most convenient plans are adopted, and the appearance of the building, the elevations and composition of blocks, grow out of the plans. The happiest effect, as with one of the schools

(Plate LIV), is where large areas of plain surface and long unbroken lines are important elements in the composition. But it is probable that much of the aesthetic effect of these buildings is in the subtle relations and sequence of simple plain blocks, and the effect of a synthetic combination of these into a unified whole. Dudok has the facility of relating these masses with a nicety and in such a way that complete satisfaction is experienced, a facility that has rarely been surpassed among modern architects. These blocks and large, plain surfaces allow for fine broad effects of light and shadow, and this is greatly enhanced by the pleasing colour of the pale red and yellow bricks. In the later work of Dudok in Hilversum the same fine unerring sense of proportion and effective use of large, plain brick surfaces is apparent. His work has had considerable influence on slightly later building in England, and there can be little doubt that many of the brick buildings in which the broad plain wall surface is an important element in the design owes something to Dudok.

The most notable architecture of Sweden in the period immediately before, during, and after the First World War was, more clearly than elsewhere, the result of a search in the past for an architecture dignified, impressive, and natively expressive. The inspiration of modern buildings like the Stockholm Law Courts, designed by Carl Westman, which were built in 1912–15 (Plate XIV), and the University of Technology, designed by Eric Lallerstedt, which was built in 1914–22, seems to have been the castles of the Wasa dynasty in the sixteenth century, the period of transition from medieval to Renaissance architecture. The chief of these castles are Gripsholm, Vadstena, Uppsala, and Kalmar. In looking at the last-named, with its large plain walls, small windows, and massive towers terminated with ogival roofs, supporting lanterns, and spires, much of the inspiration of the modern buildings cited is apparent.

Vadstena Castle is in many ways a prototype of Westman's Law Courts. The principal front of the castle with its simple massive tower clearly suggested the treatment to Westman, and one gets the impression that he wished to give his building something of the character of a sixteenth-century Swedish castle. But it has a considerable degree of originality especially in the treatment of the tower, the front face of which is flush with the wall, instead of projecting. I have already referred in Chapter VI (p. 50) to Sir Reginald Blomfield's admiration and description of this building.[1] The qualities which he admires like the abstinence from irrelevant detail, the noble scale, and the deliberate austerity of the design are precisely the qualities that are found in the sixteenth-century Wasa castles, and the deliberate austerity of design is partly the romantic return to the style of these castles, which, it seems to me, very largely prompted the character of these Law Courts.

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[1] Sir Reginald Blomfield, *Byways: Leaves from an Architect's Note-book* (London, 1929), p. 274.

A similar romanticism prompted Eric Lallerstedt's University of Technology, which has several features in common with Westman's Law Courts, especially the treatment of a tower with wall flush with the façade. This is really a small university city, because it consists of a considerable number of buildings grouped round several courts. Although there is some variety in the treatment of the various buildings, the prevailing style—the plain walls and small windows, and somewhat massive effect—is again reminiscent of the old Wasa castles. It is built of red brick, a much-favoured material in Stockholm at this time, due partly, I think, to the influence of the architecture of Holland and Hamburg, but also probably to the influence of the medieval brick buildings of Lubeck, which was another object of the romantic gaze of the contemporary Swedish architect. Here and there in the courts of the university are sculptures of a symbolic or legendary character, generally of granite, which is seen to good advantage against the red brick of the walls (Plate LIX).

CHAPTER XXIV

Tradition, Romanticism, Simplicity, and Originality—The Stockholm City Hall

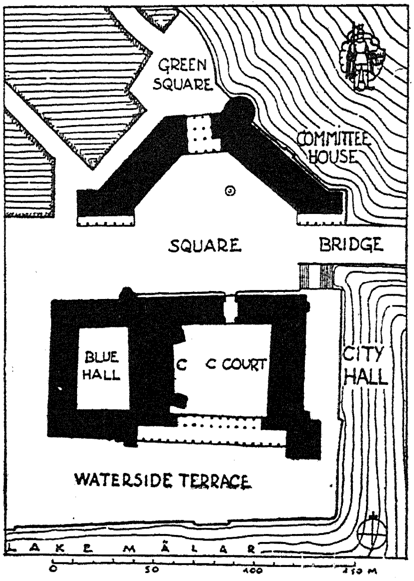
THE search of Swedish architects of this time was essentially for an expressive native style. The Law Courts and University of Technology were two results. Similarly, though more fully, the most famous Swedish building of the period, the Stockholm City Hall, was an attempt at a full expression of a people, past and present, in architecture, sculpture, and painting, suffused with all the romance that can be associated with national and local pride. If ever a building was a child of romance it is the Stockholm City Hall.

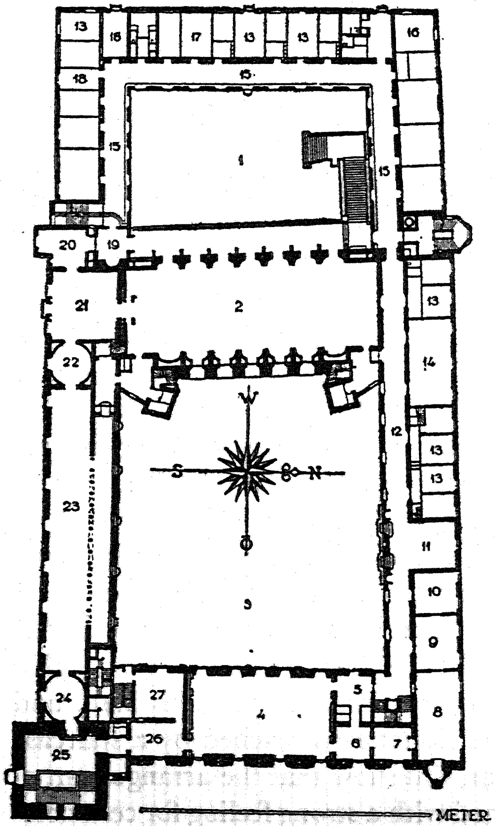
This building was commenced in 1911 and completed in 1923 to the designs of Ragnar Östberg. It is impressively situated on the north bank of Lake Malar on a corner formed by an arm of the estuary. Famous are views of the building from across the water, either from the south bank of Lake Malar or from the island of Riddarholm, which lies to the south-east in the centre of the estuary, and on which lies the old city (Plate LXI).

The City Hall is planned round two courts, the large Civic Court and the covered Blue Hall (see plans, Plate LX). If the building is approached from the City Hall Bridge, which crosses the mouth of a northern branch of the estuary to the east, one goes through the north entrance into the Civic Court, and walking to the south side sees the sparkling waters of Lake Malar through the triple colonnade. The Blue Hall is entered from the west side of the Civic Court, and this is the route generally of the public. The City Councillors go to the great tower on the south-east corner and ascend through the Arch of the Hundred to the Council Chamber on the first floor.

The building consists of ground floor, basement, and three upper floors. The first floor is the principal, being devoted to all the more ceremonial functions of the building, the remaining floors being devoted principally to offices. On the first floor, in the space between the Civic Court and Blue Hall, is the Golden Chamber, which is the principal assembly hall, and which can seat 750 at a banquet. The chamber is reached by a staircase from the Blue Hall. A study of the plan will show that the arrangement of the various apartments has been designed with a strong feeling for ceremony

TOWN PLAN OF THE CITY HALL OF STOCKHOLM (COMPLETED IN 1923), ARCHITECT: RAGNAR ÖSTBERG.





PLAN OF FIRST FLOOR

Key

1. Blue Hall
2. Golden Chamber
3. Civic Court
4. Council Chamber
5. Parlour
6. Library
7. President's Room
8. Great Sessions Room
9. Small Sessions Room
10. Chairman
11. Council Lobby
12. Council Corridor
13. Aldermen
14. Bravalla Chamber
15. Council Passage
16. Chancery
17. City Accountant
18. Attendants' Room
19. Shell
20. Blue Room
21. Three Crowns Chamber
22. Round
23. Gallery
24. Oval
25. Arch of the Hundred
26. Smaller Drawing Room
27. Larger Drawing Room

PLATE LX

combined with a sense of mystery often experienced in Gothic architecture. Consider, for example, the more ceremonial approach to the Golden Chamber from the great tower. One passes through the Arch of the Hundred along the Gallery on the south side, and through the Three Crowns Chamber which forms an ante-room to the Golden Chamber. Or consider the approach to the Council Chamber from the Blue Hall. One ascends the staircase and enters the long Council corridor on the north side and enters the Council Parlour, an ante-room to the Council Chamber. The use of long corridors is reminiscent of the corridors in the old Swedish castles (see Plates LXII and LXIII).

The main constructional material is red brick, which determines the generally vivid hue of the building. The bricks employed throughout are those often used in Sweden. They measure approximately 3¾ inches by 5¼ inches by 8¾ inches, a little higher and wider than the brick most commonly used in England.

From a constructional standpoint the great tower at the south-east corner is the most interesting part of the building. The total height of this tower above water-level to the Three Crowns is 354 feet, and the height of the brick tower is 230 feet. At the base of the tower the external measurement is 53 feet 6 inches by 55 feet. The walls are about 13 feet thick at their base. The foundation of the tower consists of a concrete platform supported on eight concrete pillars, each 17 feet in diameter, four at the corners and four at the middle of each side. They rest on the solid rock, which is higher at the north-west corner.

The tower tapers about 3 feet, and up to a height of 133 feet the wall is built solid, and this part is terminated by the vault of the Arch of the Hundred. Up to this point is a stairway and a lift, and above is a tower passage inside the thickness of the wall. The belfry at the top is constructed of wood, above is the columned circle, and above this is the small ball surmounted by the three crowns.

Many are the sources of the style of this City Hall. It is the result of a discriminating eclecticism combined with the creative genius of its architect. Many of its features recall the palaces of Venice, and the arcade on the southern side is not unlike that of the Ducal Palace at Venice. Motifs taken from Greek, Roman, Byzantine, Romanesque, Gothic, and Renaissance styles are all subjects of the architect and combined in the design.

In the capitals of the columns of the portico that runs round the Blue Hall is a variety of pictorial ornament. The entrance from the gallery of the Blue Hall in the north-east corner is Baroque in character with Ionic capitals and twisted columns; the north stairway has Roman Doric columns, with Gothic vaulting; the entrance door of the President's room is flanked with Corinthian columns; the cornice of the Blue Hall is derived from medieval castles; and the window openings are of infinite variety, square head, Roman, Byzantine, Gothic, while the terminations of the towers are derived mainly from Byzantine sources. But all this curious mixture, which seems to concentrate the whole history of Swedish architecture in a single building, is fused into an harmonious whole. With all these differences of style there is no sense of incongruity, no sense of discord, and it is perhaps the architect's greatest achievement that he has combined these several diverse styles so successfully in a single building, which is also very much a setting for the symbolic expression and pictorial history of Stockholm by means of sculpture and carving on the exterior; and fresco, mosaic, and tapestries inside. It is almost as richly ornamented with symbolic sculpture and carving as a Gothic cathedral.

The several towers have their symbols and are generally called by these names. The great tower derives the name by which it is known from the three crowns which surmount it. Just by on the eastern side is the maiden tower. North and south of the Golden Chamber are the towers surmounted by the sun and moon, while the north-east tower is crowned with Karin's sceptre. Along the cornice beneath the projecting timber on the eastern façade are a series of gilded figures in relief representing the workers of Stockholm in the 800 years of its history. Each century has its particular workers. For example, the fifteenth century is represented by the glass-worker, the wood-carver, and the warrior, and the nineteenth century by the scientist, engineer, and politician. On the northern façade are several groups of sculpture, and a series carved on the keystones above the windows represents legends and history of the eight centuries of Stockholm life. Of the three rows of capitals in the southern porticoes the inner and outer are richly carved, the inner depicting scenes from the life of youth, its work, sport, and pleasures, while the capitals on the outer row are mainly of historical and religious subjects. The capitals of the columns in the Blue Hall are similarly carved with historical and legendary subjects associated with Stockholm. Among the most interesting of the sculptures are those in the towers. On the Three Crowns tower surmounting the buttresses of the four corners of the belfry are bronze figures of Mary Magdalene, St. Nicholas, St. Claire, and Ulrica Eleanora. At the top of the Moon tower is a group in copper, of a fisher-boy cocking a snook at a bishop, which illustrates one of the old legends of Stockholm. But the most elaborate is the group on the Maiden tower, fitted with mechanism for movement. The subject is St. George and the Dragon. The contest is watched by the Princess who sits within the Maiden tower. At 12 noon and 6 p.m. the bells play, St. George leads the Princess to his horse, then comes the Page with the dead body of the dragon, and the procession moves to a gate in the great tower, which is opened by a porter.

The paintings, tapestries, and mosaics decorating the interior similarly illustrate the various legends, symbolism, and history connected with the life of Stockholm. I have tried, although very briefly in view of what there is to tell,[1] to give a fairly clear notion of the aim of this building. To the people of Stockholm it is much more than a utilitarian City Hall; it is an expression in architecture, sculpture, and painting of their history and romance. The City Hall of Stockholm is probably the most famous European building erected in the twentieth century. It has been widely and enthusiastically admired, and many who had decried twentieth-century architecture have made an exception in the case of this building.

There have been few exceptions to the chorus of approval. That learned architectural historian, Sir Reginald Blomfield, made serious qualifications in his admiration,[2] but it must be remembered that Blomfield was always prejudiced in favour of the application of classical principles to design, like symmetry and formal disposition of parts. The Stockholm City Hall follows rather medieval principles of the convenient sequence of rooms, although on the first floor with an eye to ceremonial effect. It is essentially medieval and not classic in its conception. Blomfield is unhappy about the western extension beyond the Moon tower, which he says 'goes on as it likes and ends anyhow'. On the contrary the design seems to be a careful study of the relation of masses. The convenient plan suggested the masses, but their satisfactory sequence is the result of consummate artistic treatment. What is it, after all, which makes this building so impressive, and one of the unforgettable spectacles of Europe?

All that wealth of pictorial history and legend giving richness to the building's texture is kept subservient to the controlling lines, and the silhouette of the building seen from across the water has a satisfying artistic completeness. Beginning with the vertical mass of the tower, the eye moves westward along the long horizontal mass of the southern block abutting the tower, then notes the accent of the Moon tower, and is lastly engaged by the subordinate mass of the western block, a subordination effected by a drop in the horizontal line. The subtlety of that drop can be appreciated on nearer view (Plate LX). The Baroque summit of the Moon tower may contribute nothing to the sequence of masses, but it introduces a note of gaiety which, with so many other factors, constitutes the appeal of the building to such varied taste.

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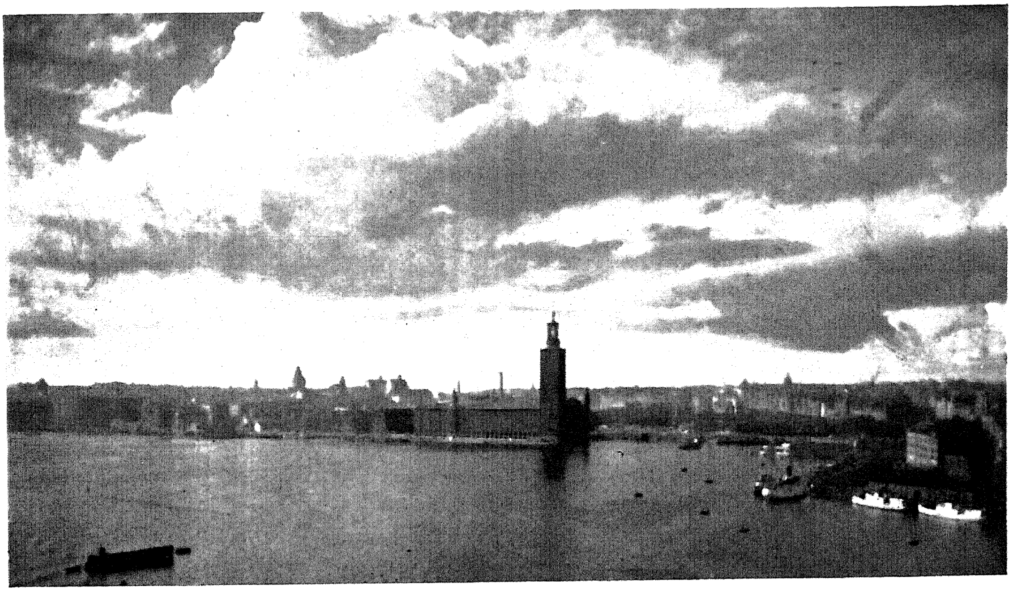
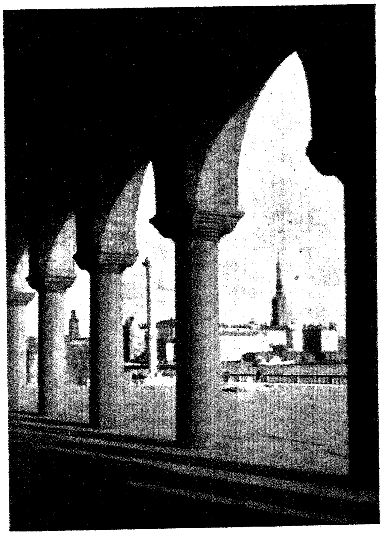
[1] Further information about the profuse decoration of this building can be obtained from a guide written by the architect (Stockholm, 1926).

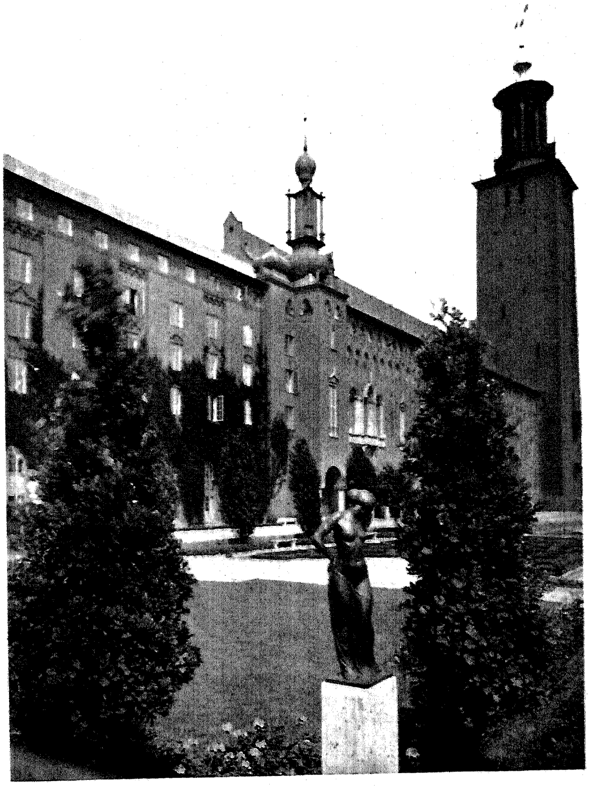
[2] Op. cit., pp. 274-9.



THE CITY HALL OF STOCKHOLM SEEN
FROM THE RIVER (COMPLETED 1923)

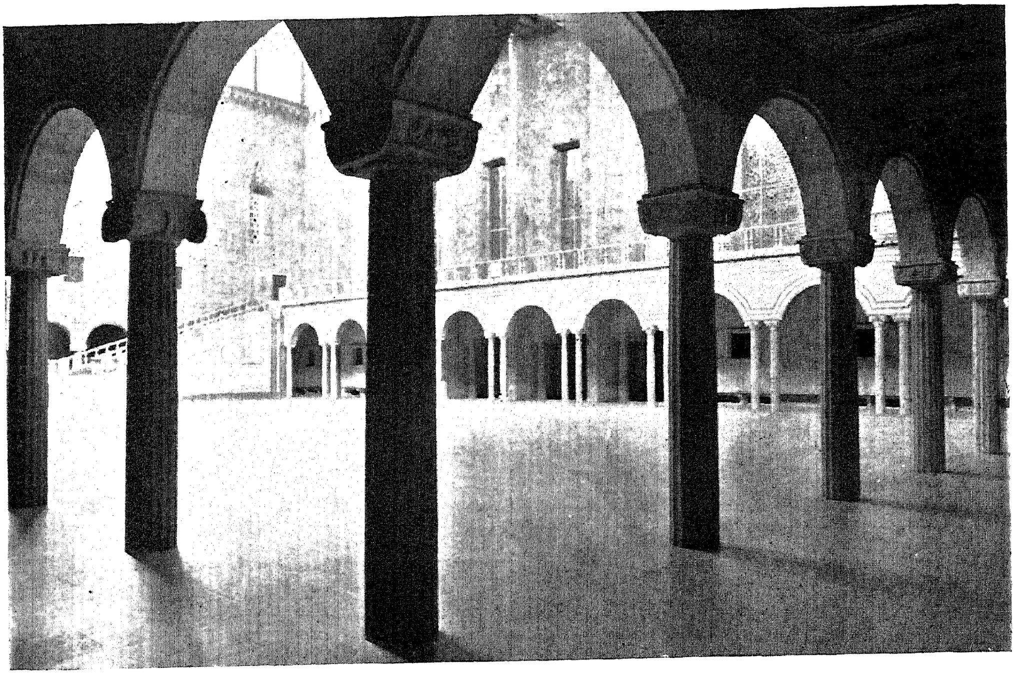
THE SOUTHERN PORTICO AND
THE WATERSIDE TERRACE



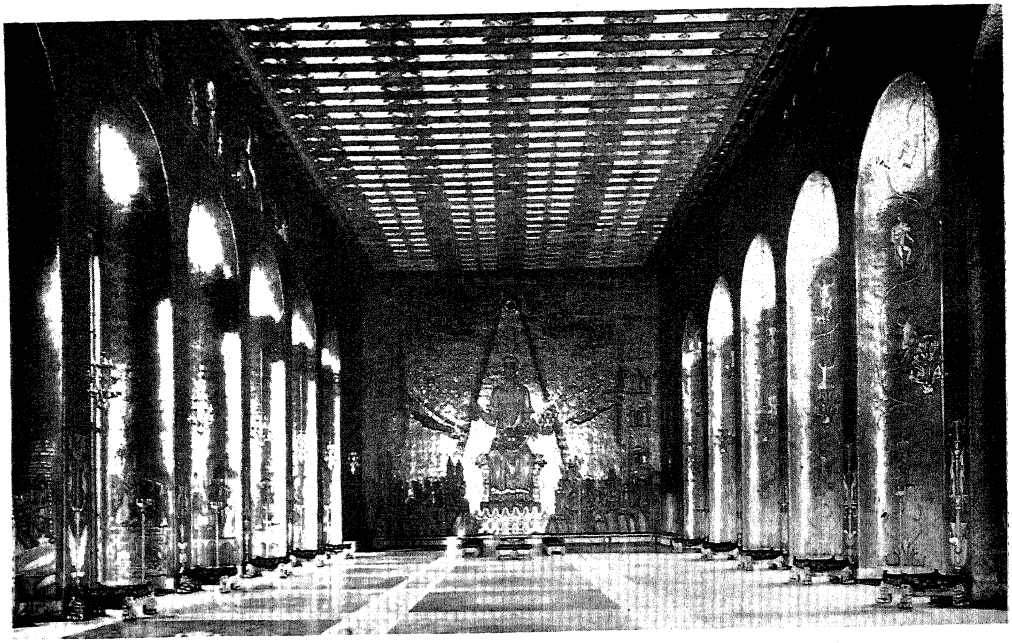


A VIEW OF THE BUILDING FROM
THE SOUTH TERRACE

PLATE LXI



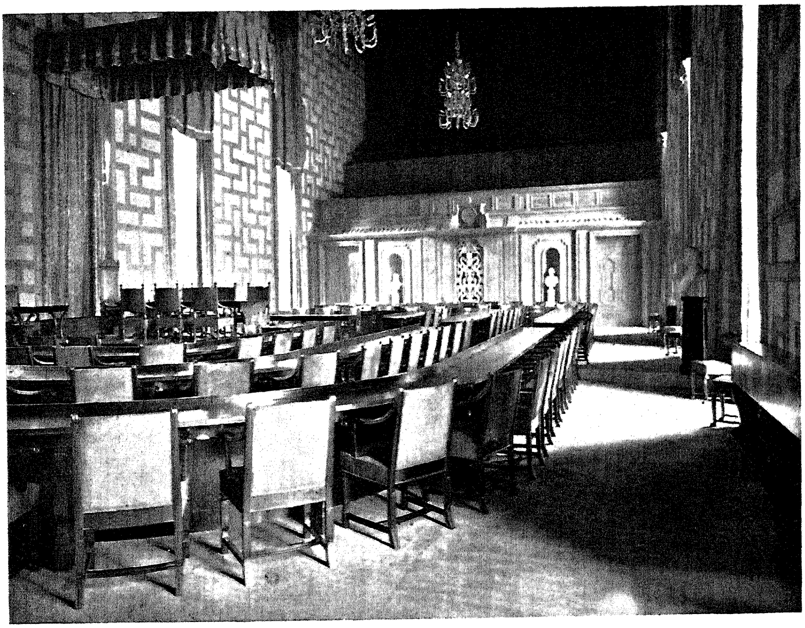
THE BLUE HALL



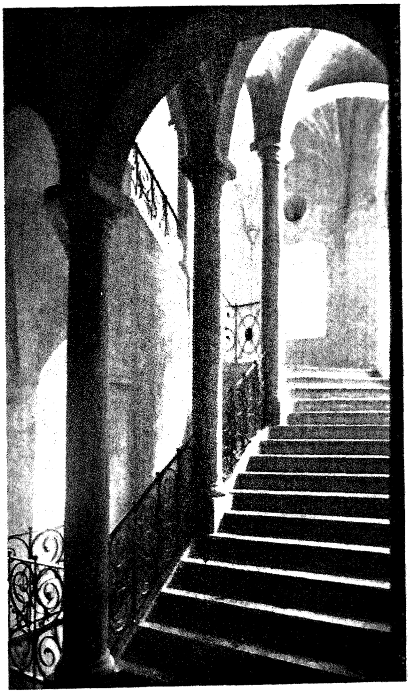
THE GOLDEN CHAMBER, WHICH SERVES AS THE MOST REPRESENTATIVE HALL OF ASSEMBLY FOR THE CITY. THE CHAMBER IS ABOUT 140 FEET LONG, 43 FEET BROAD, AND 37 FEET HIGH

THE STOCKHOLM CITY HALL, INTERIOR VIEWS

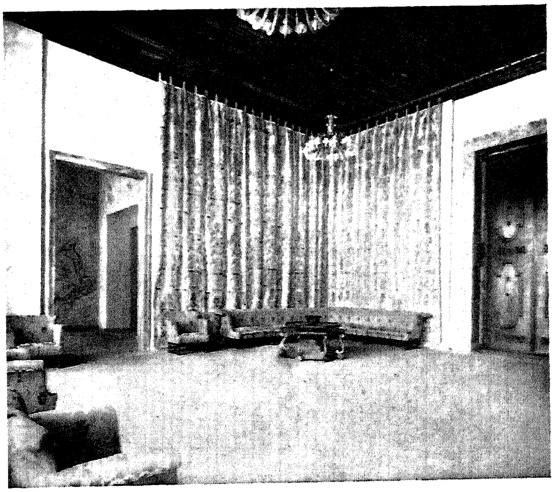
PLATE LXII



THE COUNCIL CHAMBER



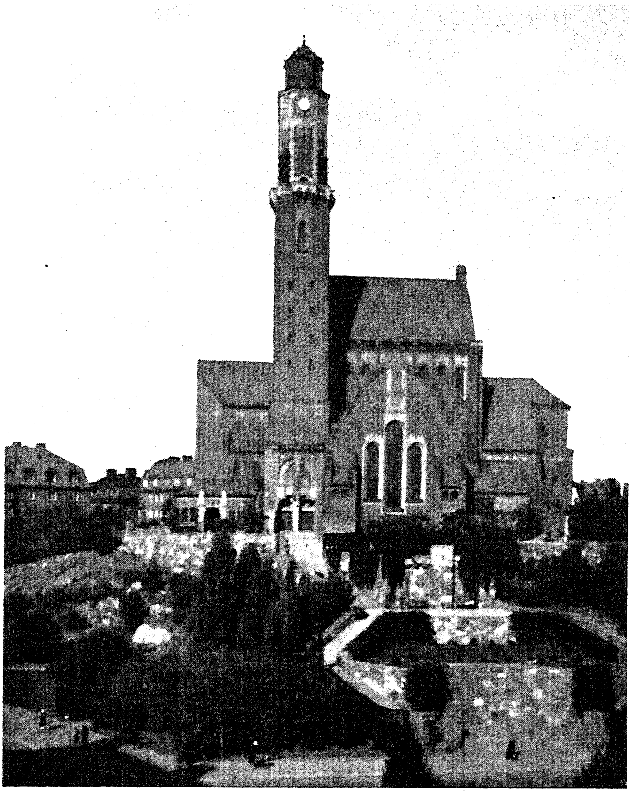
THE NORTHERN STAIRWAY WITH COLUMNS OF MARBLE



THE THREE CROWNS CHAMBER, WHICH FORMS AN ANTE-ROOM TO THE GOLDEN CHAMBER (SEE PLATE LXII)

FURTHER VIEWS OF THE INTERIOR OF STOCKHOLM CITY HALL

PLATE LXIII



THE ENGELBREKT CHURCH, STOCKHOLM
Architect: L. I. WAHLMAN
(1908–14)

INTERIOR OF SAME BUILDING

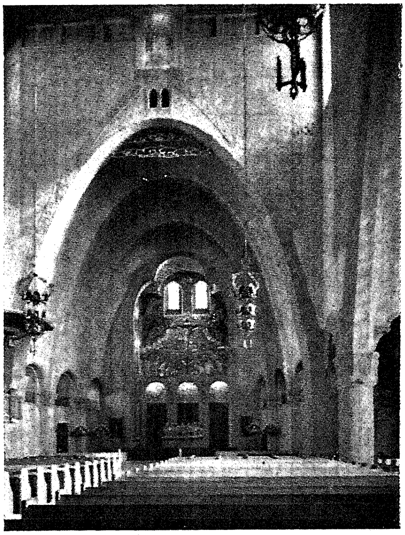
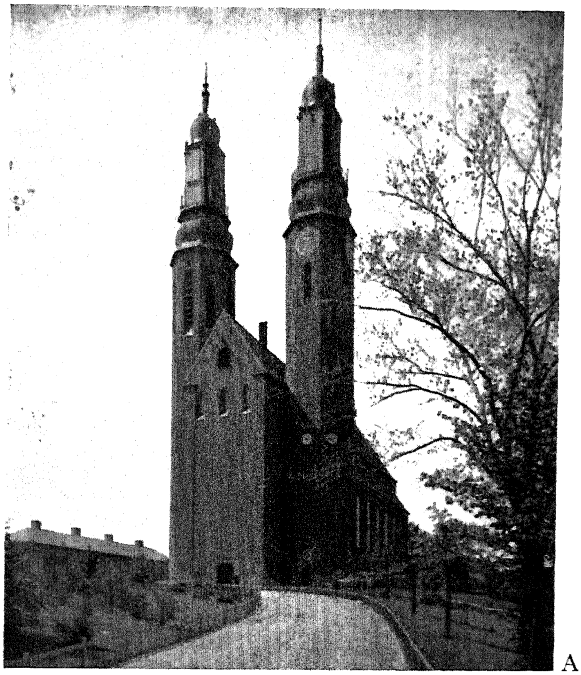
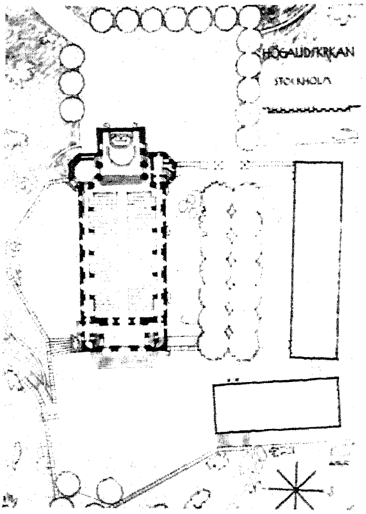


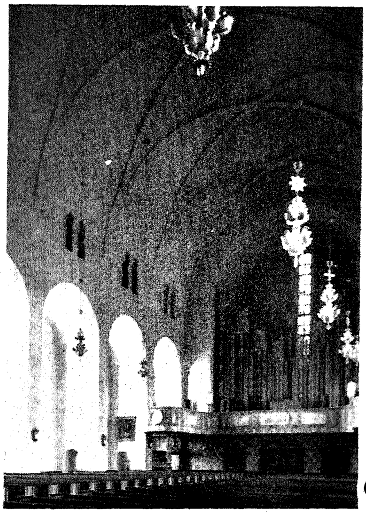
PLATE LXIV



A



B



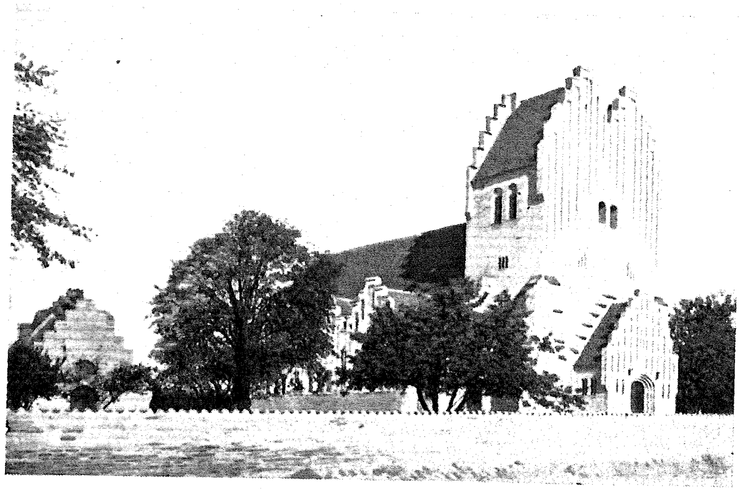
C

A. THE HÖGALID CHURCH, STOCKHOLM
Architect: IVAN TENGBOM (1918–23)

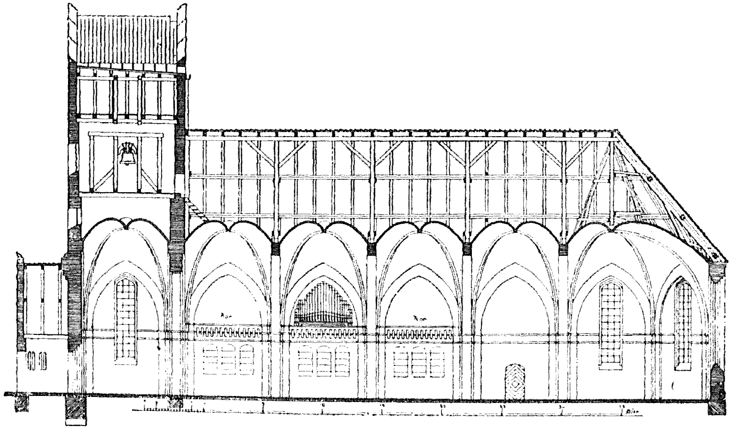
B. SITE PLAN OF THE HÖGALID CHURCH

C. INTERIOR OF THE BUILDING

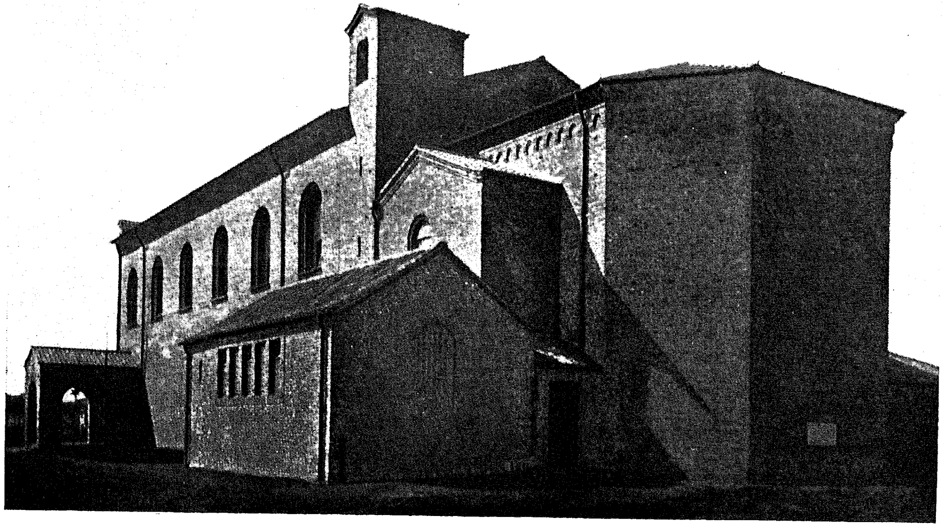
PLATE LXV



ST. HANS TVEJE CHURCH, NEAR ODENSE, DENMARK, SHOWING A MODERN EXAMPLE OF THE USE OF THE STEPPED GABLE. *Architect*: P. V. JENSEN FLINT

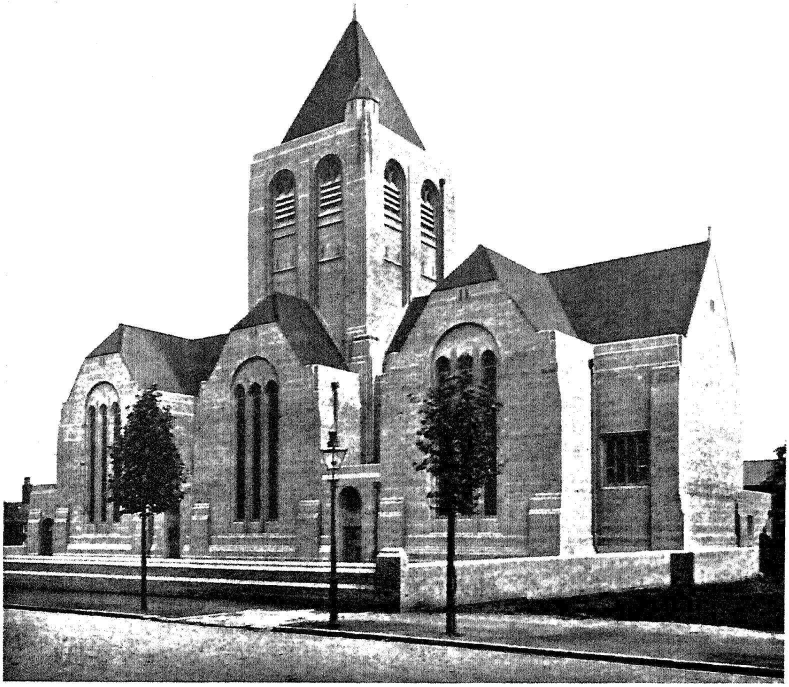


VERTICAL SECTION, ST. HANS TVEJE CHURCH

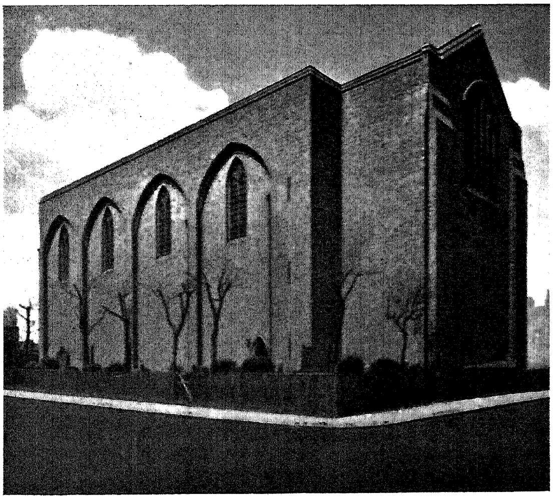


ST. CATHERINE'S CHURCH, HAMMERSMITH, AN EARLY ENGLISH EXAMPLE OF A STEEL-FRAMED CHURCH BUILDING
Architect: ROBERT ATKINSON (1922)

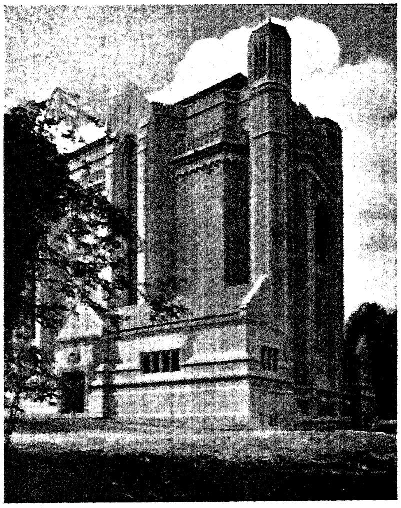
PLATE LXVI



ST. PAUL'S CHURCH, DERBY LANE, LIVERPOOL
Architect: SIR GILES GILBERT SCOTT (1922)

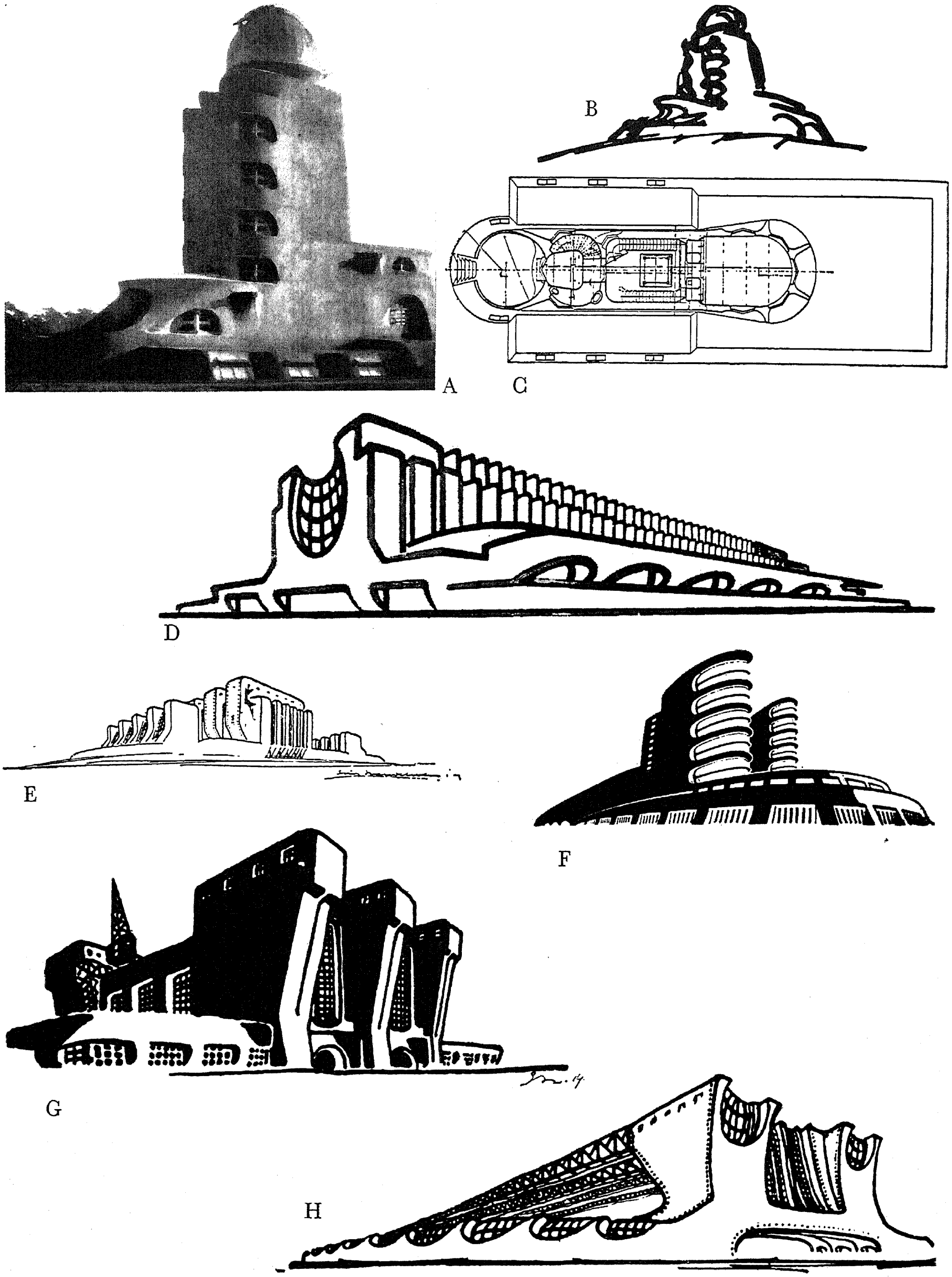


ST. STEPHEN'S CHURCH, GRIMSBY
Architect: WALTER TAPPER (1922)



THE WAR MEMORIAL CHAPEL AT CHARTERHOUSE
Architect: SIR GILES GILBERT SCOTT (1922–6)

PLATE LXVII



DESIGNS AND SKETCH PROJECTS BY ERIC MENDELSOHN

A. EINSTEIN TOWER, POTSDAM (1920). B. SKETCH FOR SAME BUILDING. C. FIRST-FLOOR PLAN

The remaining illustrations are sketch projects made between 1914 and 1918

D. GOODS STATION. E. CHEMICAL FACTORY. F. OPTICAL FACTORY. G. INDUSTRIAL BUILDINGS. H. MOTOR-CAR CHASSI
FACTORY

PLATE LXVIII

CHAPTER XXV

Tradition, Romanticism, Simplicity, and Originality—Some Churches

THE romantic adaptation of ideas culled from the remote past, combined with considerable originality, had interesting manifestations in many churches built during the period under review. It will not be possible to allude to more than a few examples, but these are among the best and may be taken as representative of others showing similar tendencies.

Two of the most interesting and original of these churches are in Stockholm, the Engelbrekt church, designed by L. I. Wahlman and built in 1908–14, and the Högalid church, designed by Ivar Tengbom, and built in 1918–23. The design and style of both of these churches have been based partially on German and Swedish Romanesque, but both are, at the same time, original conceptions. The Engelbrekt church (Plate LXIV A) is built on a rocky prominence, which gives it a situation elevated above its surroundings. Full advantage has been taken of this situation. The church is built of brick with Greek cross plan, the central space rising higher than the arms, while a tall, slender tower rises at the corner, formed by the central space and southern arm. This tower is square two-thirds of the way up and then changes to an octagon and to more ornate treatment. The design of the interior is open without aisles and with a clear view of the altar. The choir, nave, and transepts have vaults consisting of a series of high elliptical or parabolic arches rising from the walls, and the bays are a series of circular arches. The whole effect is massive and simple, full effect being given to the unbroken lines of the parabolic arches, which are its most distinguishing and original feature (Plate LXIV B). Sir Reginald Blomfield admired this church greatly and he alluded to it as 'much the most original and in some ways effective modern church that I have seen in any country'.[1] Another church by L. I. Wahlman is the Swedish church at Oslo, built a little later, but this is small and a much less ambitious work, although in features, like the flat elliptical-headed narrow windows and the square tower surmounted by a series of diminishing octagons for the spire, not unlike that of St. Bride's, Fleet Street, it clearly betrays the same designer.

The Högalid church is similarly well situated on a hill on Södermalm (Plate LXV A), and full advantage again has been taken of the situation, so that this lofty architectural composition with tall twin towers at its eastern end dominates the surroundings. It is a well-known landmark, and can be seen from Lake Malar and most parts of the city. Like the Engelbrekt church it is built of red brick and is inspired very much by Romanesque architecture. The conception of these towers is based on those of Visby Cathedral, on the Island of Gotland, and the architect may also have been influenced by some German Romanesque churches. But in this octagonal tower with wide bulbous moulding, changing to square and surmounted by onion terminations, Byzantine influence is as strong as Romanesque (Plate LXV A). The church has a rectangular basilican plan, and the interior, less exotic in treatment than much of the exterior, has lofty semicircular vaults, with a series of circular arched bays in the wall. The whole is open so that one has a clear view of the altar from all parts (Plate LXV B and C).

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[1] *Byways: Leaves from an Architect's Note-book* (London, 1929), p. 271.

This church represents an interesting departure from the usual course of Tengbom's work. Most of his preceding and succeeding work was more in the classical tradition, although treated with originality and personal feeling. One of the most important of his earlier works was the Stockholm Enskilda Bank, which was completed in 1915. This building is essentially a simplified rendering of classical architecture with an emphasis on monumental massiveness. His later work in the classical vein, like the Concert Hall, Stockholm, will be considered later.

The history of Swedish and Danish architecture shows that they followed the many stylistic developments that spread over Europe—Romanesque, Gothic, Renaissance—but there were often national and local characteristics which became strong distinguishing features. In the medieval architecture of Skane, which forms the south-western tip of Sweden, and which was once part of Denmark, there are distinguishing features of many of the buildings which mark them from the work of other areas in Sweden and Denmark of the same period. One marked feature is the prominent stepped gable seen in many buildings, such as the Glimmingehus, a work of the end of the fifteenth century, and Troup Castle, a work of the sixteenth century. It is this prominent feature which has dominated the conception of the exterior design of St. Hans Tveje Church near Odense in Denmark (begun in 1921 but not completed until 1940), but the motif has been applied by the architect, P. V. Jensen Klint, with considerable originality. The plan is rectangular with a deep aisle three bays long to the south. The western end of the church is terminated by a half-octagonal apse, and the eastern end has a low rectangular tower terminated by a double pitched roof faced with step gables which are emphasized by a fluted decoration on the front façade terminated in the form of a triangular plain wall (Plate LXVI). The treatment is repeated for the porch on this front, and for the three bays of the aisle on the south side, and it is this motif, suggested by fifteenth- and sixteenth-century buildings of Skane, which determines the style of the exterior. The fluted wall design is an interesting decorative emphasis. The interior of the church has Gothic arches for the wall bays, and parabolic arches for the roof vaulting, again a mixture of traditional and original treatment which is interesting if not entirely successful.

The tendency towards simplicity that we have noted in the twenty years before the First World War, and which became stronger after the war, was not without its influence in ecclesiastical art. We have noted how, with the gradual breaking from the mechanical and imitative work of the Gothic revival, inspiration was sought from still earlier styles like Romanesque and Byzantine. At the same time there was a desire among many ecclesiastical architects, a desire imparted to some extent by the clergy, to give a more religious, less worldly atmosphere, to their interiors. It was logical that they should turn to the early days of the Church, and thus those phases of early Christian architecture in which the religious atmosphere seemed strongest made a special appeal. The simplest and most austere churches, in which a sense of space was also apparent, formed the most satisfying examples for study. The results of this study began to appear in many churches built in the period following the war. Also the high costs of material and labour at this time demonstrated that austerity and simplicity had economical advantages.

But another factor, at least as important as any, was responsible for the changes that were taking place in church design. The movement to design more strictly according to suitability for purpose, which was one of the essential contributions to a new architecture, exercised some influence on architects of churches. The question was asked afresh, what is the purpose of a church building, and what form serves that purpose best? The answers varied with the religious denomination, but that which might be given for the Protestant church would be that a church is built to give shelter to a number of people of a parish to worship God; it is, therefore, an assembly hall, with an altar as a focal point, in front of which there is space and facilities for priests to conduct that worship, and to give religious instruction and guidance. Ceremony, music, and decorative art are forms of beauty which felicitously conduce to worship.

Now does the traditional cruciform plan, with aisled choir and nave, serve the purpose best? It was the traditional form from the early Middle Ages, beginning generally with Romanesque churches, until the Reformation.

When the first Protestant churches were built after the Reformation, such as the Wren city churches, the cruciform plan gave place to the rectangular plan, and the church interior became closer to the secular assembly hall. The aisles were retained in many cases, but what was the triforium became a side gallery.

With the Gothic revival the cross plan returned, but from about 1910 this consideration of designing according to suitability for purpose began to effect changes in church plans, because the reply to the question whether the cruciform plan with arcaded aisles, choir, and nave serves the purpose of the building best could not always be given an unqualified affirmative. For the purpose of ceremony and processions, yes; but for the purpose of seeing the priest conducting the worship near the altar, for the purpose of seeing the preacher, for the purpose of that desirable religious unity of the many worshipping as one, it was clearly not the best plan, particularly for those seated in the aisles, who suffered from the obstructions of the columns in the nave, or those seated in the transepts, who often had several obstructions of different kinds.

The most drastic change to overcome these difficulties is to revert to the rectangular plan, and eliminate arcade aisles, but there are varying degrees of compromise, one being to have the rectangular plan, yet retain aisles, make them narrower, and use them only as corridors. In many churches built in England from 1910 to 1925 some of these varied solutions can be seen, but it is rather a negative process of deletion; there is as yet no stating the problems and finding an entirely new solution. That was to come later.

Thus in many churches we find the cross plan abandoned, and the rectangular basilican plan adopted either with or without arcaded aisles. At the same time a growing simplicity and austerity are apparent. Brick or stone walls are covered with plaster, and often plain columns with simple bases and capitals are employed.

The complete effects of the tendency are not manifest until later, the church work from 1919 to 1924 being, as already implied, largely transitional. The three churches from Sweden and Denmark that we have just considered may come in this category, but they are distinguished by an uncommon degree of originality. More pedestrian work moving in the same direction may be found in many excellent churches of this period, some interesting examples being in England. A few of these are simple brick churches, often with no tower or spire, in which large surfaces of plain wall, both externally and internally, are conspicuous characteristics—churches like St. Stephen's, Grimsby, designed by Walter Tapper, St.

Saviour's Church, Acton, by Edward Maufe, and St. Catherine's Church, Hammersmith, by Robert Atkinson (Plate LXVI). The last mentioned is particularly interesting as being, as far as I know, the first steel-framed church building in England. The steel frame was adopted because at this time it represented a saving in time and cost. It was completed in 1922 in six months at a cost of £16,000, and it is estimated that if the traditional methods of building had been adopted it would have taken double the time and money. The plan is rectangular, it has brick exterior facing in which large plain surfaces contribute much to the effect, the windows have semicircular arches, while the barrel-vaulted interior has a dead white plaster finish, with a black dado. The conception has been inspired by the simpler early Christian churches of Italy.[1] Many later churches in England are constructed and designed in a similar manner.

During this period in England, however, the dominating ecclesiastical work is that of Sir Giles Gilbert Scott, yet the tendencies noted are apparent in his work too, conditioned always by the characteristics of his strong individual style. Among the churches Sir Giles Scott built during this period are St. Paul's Church, Liverpool, the Church of Our Lady, Northfleet, Kent, and the War Memorial Chapel at Charterhouse (Plate LXVII). In these churches there is the change from the traditional cruciform plan to the rectangular plan. The architect of Liverpool Cathedral is most apparent in the church at Northfleet, where the conjunction of Gothic forms with classic restraint, and emphasis on horizontals and verticals is reminiscent of the cathedral. The square opening from the nave to the choir, the triple clerestory windows, enclosed in a square head, are examples of this, while the massive square tower is a foretaste of that for Liverpool Cathedral. St. Paul's Church is very different (Plate LXVII). The liking for plain wall-surfaces is apparent, but the composition of the exterior is essentially of triangular forms—of pitched roofs and pyramidal spire surmounting the square tower—and of circular arches—that enclose the triple windows, and which terminate the recesses of the tower.

The War Memorial Chapel at Charterhouse is more traditional, inspired by the period of transition from Romanesque to Gothic. In the wall structure and the turrets at the ends there is the Romanesque character, but most of the arches are Gothic, but less sharp than Early English. The tall lancet windows are recessed from the interior wall and on the exterior the series of projections with gable tops and buttresses framing the windows are reminiscent of Liverpool Cathedral. It is eclecticism to a degree, but very much in the spirit of the Romanesque–Gothic period of transition.

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[1] A description with an illustration of the steel-frame construction is given in *The Architectural Review* for July 1923, vol. liii, p. 209.

In these last three chapters I have dealt mainly with that Romanticism which aimed at combining the styles and beauties of a remote past with some degree of originality in design. There were other kinds of romanticism, and some of the work of German exponents of the new architecture can be rightly classified as romantic, such, for example, as some work of Hans Poelzig in conceptions like the remodelled Grosse Schauspielhaus with its concrete stalactites, or Eric Mendelsohn's Observatory at Potsdam. But here is romanticism of a totally different kind, which does not invoke the search among traditional styles. Poelzig may have had in mind the cave with stalactites as a subject for his decorative purposes, thus representing a search, not among architectural but natural forms, while Mendelsohn was clearly thinking of optical instruments as suggestions for the decorative forms of his structure. These are non-traditional experiments in expression, and although romantic in the more adventurous sense they obviously belong to a study of the development of the new architecture, of which they are phases, and which will be the subject of the next chapter.

CHAPTER XXVI

Functionalism, New Forms, and Experiments

THE most important developments leading to the new architecture were discussed in Chapter XV. They can be briefly re-stated for the convenience of the reader as an increasing appropriateness of form to function, the sloughing of ornament derived from past styles, the use of materials with greater structural potentialities provided by modern industry, and the closer study of economic and social needs in relation to building. These developments were not made without the consciousness that building, if it is to be architecture, must afford some degree of aesthetic delight, but it was accompanied, at the same time, by the conviction that beauty can be discovered in hitherto unsuspected places, and that much that was once regarded as merely utilitarian can give aesthetic delight. In Chapter XXIII it was repetitively stated in another form that the creative process resulting from the developments enumerated was prompted by reasoning on contemporary building needs, on the purpose of a building, on methods of construction, and on the logical emergence of design from these consistent with beauty. But again that beauty might be entirely new and hitherto unsuspected. As we have seen, many of the principal characteristics of the new architecture were apparent in some of the buildings by Peter Behrens, Walter Gropius, Heinrich Tessenow, Adolf Meyer, Tony Garnier, Auguste Perret, and a few others erected in the years preceding the First World War. That war just meant a pause in the evolution, and the movement was renewed with increasing vigour. This vigour was imparted somewhat by many young newcomers to the scene, among them Le Corbusier, Eric Mendelsohn, Ludwig Mies van der Rohe, and J. J. P. Oud.

We have noted that many of the most important pioneer developments took place in industrial buildings, and buildings with a strongly utilitarian and non-ceremonial function. Particularly in the later pre-war (1914–18) stages of the evolution many of the principal developments were in industrial buildings, and the turbine and electrical factories of Behrens, and the Fagus shoe-lace factory of Gropius and Meyer were cited as outstanding examples. It is not surprising that industrial buildings should be prominent in the vanguard of the new movement because with these more than with most other types efficient fulfilment of purpose is a matter of some economical urgency. The progressive manufacturer will hardly allow traditional forms to interfere with the most efficient adaptation of premises for the purpose they have to serve, and any improvements such as the use of materials that could effect more rapid and economical building, and new methods of construction that could assist and render more efficient processes of manufacture were generally welcomed. The argument that retarded the development towards a living architecture in many other types of building, the argument which says that this traditional form has served us very well in the past, that the principles of design by which it is built have been followed with success since the days of Ancient Greece and Rome, and produced some of the finest architecture in the world and thus we must be very careful before we depart from these well-tried methods, had little weight in the design of industrial buildings intended for processes of manufacture that were new and constantly changing, and for which there existed little tradition. But even though this was generally the case there were many industrialists and their architects who aimed at giving beauty and dignity to their factories by architectural embellishment borrowed from past styles. Both architect and industrialist would consider it bad business to allow such embellishment to interfere too much with the efficiency of the building, but in many cases efficiency suffered a little. Where the utmost light is desirable and a maximum is obtained by a glass façade like that in the Fagus shoe-lace factory the introduction of classic stone columns or pilasters on the façade would obviously defeat that purpose in some degree. But the industrialist and his architect responsible for this might argue that a factory with a handsome and beautiful appearance is an advertisement for the products manufactured there, and is also of value to the reputation of the firm. This argument is even stronger with some forms of commercial buildings, such as departmental stores. In these, large open spaces with a maximum of light are desirable, therefore a street façade with large glazed areas is the most efficient. To introduce classic pilasters or columns, as in the Selfridge building in Oxford Street, London, is to reduce the light. But a magnificent classic façade, it would be argued, gives beauty and magnificence to the building, and this is valuable as a magnet for customers, and is worth the sacrifice of a little light.

This kind of thought was obviously common during the years before and after the First World War, and it was probably the thought of the majority of industrialists and architects. It has persisted with a decreasing number since. Where the industrialist did not bother to beautify his factory, these embellishments were eschewed and there was exclusive concentration on efficiency. It is work of this kind that was partially conducive to the development of an architecture expressive of the age. It is thus clear why industrial buildings in this early stage made the greatest contribution to the development of such architecture.

But there is another category of industrialist and architect (probably the industrialist led by a progressive architect), the rarest of all, who made the most vital contribution. They are those who believe that the industrial or commercial building should serve its purpose with the utmost efficiency, and should be designed accordingly; they also believe that it should be beautiful, but that its beauty should not be acquired by the use of embellishments derived from past architectural styles, but should emerge directly from the purpose and construction of the building. The architects and industrialists who could think like this before 1914 were rare. We have already considered those who could do so—Behrens, Gropius, Meyer, Garnier, Perret, and a few others. This was a logical process of design, but what prevented the majority thinking and acting in this logical way was the inability to see beauty in these industrial and commercial buildings of steel and concrete which were in their appearance a logical expression of purpose and structure. The beauty had to be discovered as the beauty of any startlingly original work has to be discovered. When first created such a work is subjected to abuse for a period, whether it be a musical composition of Stravinsky or Bartok, a Pre-Raphaelite, Impressionist, or Surrealist painting, or a stone carving of Epstein (all of which were of the kind that suffered heavy abuse). Later the antagonism dies, the admirers increase, and often the work takes its place among the beautiful creations for which we are grateful. This is very much the case with the architecture of steel and concrete. When no aesthetic claims were made for it, and it was just a racing stadium or a factory or a bridge serving a utilitarian purpose, when it was, in fact, just building, it met with no antagonism. But when aesthetic claims were made for it, and this type of architecture was employed for buildings in the centres of our cities, which are often partly settings for traditional ceremonies, and for our homes, then the antagonism was strong, precisely because of this inability to see beauty in the new and strange.

The number of notable people in the nineteenth century who, like Ruskin and Morris, could see no beauty in structures of iron or steel was legion. Morris, staying in Paris as near as possible to the Eiffel Tower, as this was the only place in Paris where he could not see it, was symbolic. The average manufacturer desiring to give beauty to his factory, or shopkeeper desiring to give beauty to his departmental store, turns to the established architectural traditions; the stark factory or store of unornamented steel, concrete, and glass, depending for beauty on proportion, mass, line, and light and shadow, was aesthetically negative to him. He would laugh at the suggestion of its aesthetic interest and remark: 'You can't call that sort of thing beautiful—more likely to turn people away. It's all right for a factory in a back street, or out in the country where not many people can see it, or in one of the industrial towns that is already damned ugly.'

Here, then, was the great problem in the development of a new and living architecture in which the materials provided by modern industry are used logically and to their fullest extent. The battle is still being fought. The result is not in doubt because it is inevitable, and that inevitableness is clearly apparent in the twenty years between the wars. But while the appreciation of the new architecture presented difficulties to the majority in the years succeeding the First World War, the pioneers already mentioned and a number of younger architects were enthusiastic for the beauties of the architecture of steel, concrete, and glass, and coupled with this they were also enthusiastic for the beauties of many machines that were evolving in our civilization, like the aeroplane and motor-car, the modern locomotive and the liner.

This enthusiasm is the spirit of Le Corbusier's book *Vers une architecture*,[1] published in 1923, which aroused widespread interest in Europe and met with no small amount of abuse and derision from among older traditionalist architects. One important section of the book is entitled: 'Eyes which do not see', with sub-sections dealing with liners, aeroplanes, and automobiles, in which Le Corbusier seeks to show how, as they develop, they are designed more and more strictly for the purpose they have to fulfil, and how they conform to the same principles of design as the great examples of classic architecture like the Parthenon. Under one illustration of the front-wheel brake of a Delage motor-car, he says: 'Cette précision, cette netteté d'exécution ne flattent pas qu'un sentiment nouveau, né de la mécanique. Phidias sentait ainsi; l'entablement du Parthénon en témoigne. De même les Égyptiens lorsqu'ils polissaient les Pyramides. C'était au temps où Euclide et Pythagore dictaient la conduite de leurs contemporains.' (This precision and this neatness of execution do not belong only to a new born feeling for mechanism. Phidias felt like that; the entablature of the Parthenon is evidence of this. It was the same with the Egyptians when they were finishing off the Pyramids. It was at this time that Euclid and Pythagoras were dictating to their contemporaries.)

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[1] English translation by Frederick Etchells under the title *Towards a New Architecture* (London, 1927).

Le Corbusier points out that design of things of use—aeroplanes, motor-cars, buildings—evolves towards a standard and then efforts are made to perfect and beautify that standard. He remarks that 'Phidias, in building the Parthenon, did not work as a constructor, engineer or designer. All these elements already existed. What he did was to perfect the work and endue it with a noble spirituality.' Le Corbusier thus sees in modern building, becoming more and more machine-like, because the essential constructional material—steel—is the same, similar principles of design and the same evolution as in the great architecture of the past. Le Corbusier noting the parallel sees in the new architecture possibilities of beauty of the same high order as in the classic architecture of Greece.

What was, however, more significant than this book were the sketch-projects of buildings of steel, concrete, and glass made by many young architects, in which there was obviously considerable aesthetic delight in the forms resulting from the use of these building materials. Among the most noteworthy of these sketch-projects were those of the young Eric Mendelsohn made from 1914 to 1920. His earliest sketches of buildings like halls, law courts, and religious buildings are classical in character, but after this start Mendelsohn concentrates mainly on industrial buildings. He conceives these in terms of steel and concrete, using those materials according to their character, and letting them largely determine the forms of the building.[1] As Sheldon Cheney says, 'Mendelsohn in these sketches made buildings expressive of the "feel" of the machine!'[2] What is important, however, is that although acutely sensitive to the architectural beauties of the past, especially of Greek and Gothic architecture, Mendelsohn realized that the architecture of today is an architecture of an industrial civilization in which the materials are steel, concrete, glass, while various new materials are being constantly invented, and that the creative imagination of the architect must work in these terms. The very nature of the sketch-projects demonstrates that they were made partially with an aesthetic purpose. I illustrate a selection (Plate LXVIII). It will be seen that most of them are industrial buildings conceived in terms of the tensile strength of steel, that linear emphasis is strong, and that they were designed with the feeling for the character of the modern industrial machine. Few people now are insensible to the elements of beauty that they possess. Indeed it is perhaps the aesthetic element which is the strongest, for Mendelsohn is primarily one who looks at all things with the eyes of an artist. With the artist there is often the necessity of taking a subject for expression apart from mere decorative emphasis of a utilitarian structure, and thus we find in many of these sketches a tendency towards the use of forms which are symbolic of the purpose of the building, as the verticality of a Gothic church is symbolical of aspiration. Of the sketches illustrated it is clearly apparent in the optical factory and the goods station, and we see it even more marked in the Observatory at Potsdam.

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[1] Many of these sketches are illustrated in my book on *Eric Mendelsohn* (London, 1940).

[2] *The New World Architecture* (London, 1930), p. 97.

Mendelsohn had been trained as an architect, but from 1912 to 1914 he had been occupied with stage designing and painting and had been greatly influenced by the German Expressionist movement. These circumstances coupled with other influences like *L'Art Nouveau* and the work of Van de Velde considerably affected Mendelsohn's approach to architecture. In these three influences we find the emphasis of linear rhythms prominent. German Expressionism, which was one of the movements leading to Surrealism, was largely a reaction against Impressionism and was formed partially under the influence of Van Gogh and Edvard Munch, in whose work linear rhythms are used as a vital expressional medium, in the one as expression of the life and growth of natural forms in the landscape, and in the other as an expression largely of human emotion. We have seen in Chapter V the importance of linear rhythms in *L'Art Nouveau* and how Van de Velde tried to associate rhythmical lines with organic forms and the sense of growth. This was a powerful influence on Mendelsohn and we shall discuss later his ideas of organic unity. For the moment we must be content to observe that the very strong feeling for line in Mendelsohn's work, due very largely to the influences I have mentioned, was from the first wedded to the tensile qualities of steel as a structural medium. We see it in the sketches, and in much of his most important work, but even when this association is not so determining a factor in design, the linear quality is still strong, as in his early Observatory at Potsdam.

Indicative of the general feeling towards the machine-like architecture of Mendelsohn's sketches, is the startling effect they produced when exhibited at Paul Cassirer's Galleries in Berlin in 1919 under the title of 'Architecture in Steel and Reinforced Concrete'. Many architects and critics were puzzled, some derided them as not architecture, while they aroused enthusiasm among others. But the chief difficulty seemed to be to accept this kind of work as architecture.

Mendelsohn's earliest important building completed in 1920, the Einstein Tower at Potsdam, was very much one of these small sketches realized in an actual structure. It was because Findlay-Freundlich had seen Mendelsohn's sketches for Observatories that he recommended him to Einstein and the German Government as the architect for this Observatory to be built for further researches into Einstein's theory of relativity. The building was conceived in reinforced concrete, and was begun in this material, but the principal part was built of brick and covered in cement rendering, although the top part was finished in concrete. The building has been criticized on the grounds of its construction; some have said: being conceived in reinforced concrete and built of brick it is a constructional sham. The reason for the brick construction has been variously stated, one suggestion being that it was difficult at the time to procure adequate quantities of cement; but what I think was more likely were the difficulties encountered in making shuttering economically for a round tower of this kind. What, however, must be emphasized is that it was built as originally conceived in the sketch (Plate LXVIII A and B) and that brick was a substitute material. Linear rhythm is a guiding factor in the design, while in its forms there is clearly symbolism of optical instruments, seen especially in the deep curved window recesses which allow for an interesting play of light and shadow, while there is a sense of the mysterious in the building which for ever hovers over subjects like physics and astronomy.

The inability to reconcile direct expression of structure and purpose of a modern steel-framed or concrete factory or departmental store with ideas of beautiful appearance, that is, architecture, was symptomatic of a general divorce of art and modern industry which existed in the nineteenth century. We have frequently alluded to the reactions to this divorce in former chapters. Art was something applied, like the columns of the Selfridge store, and the real structural form of half the objects produced for the home in the second half of the nineteenth century was obscured by irrelevant ornament grafted on. The realization that the unique beauty of an object arises from its character, and that this must emanate from its purpose and structure and can belong to the products of the machine as well as to the products of hand craftsmanship, was very slow in coming. We know that William Morris turned his back on modern industry, but the Deutsches Werkbund, founded in 1907, was the first effort on a big scale towards this realization. As noted in Chapter V it grew in strength and it led to the formation of similar associations in other countries. In the spring of 1919 Walter Gropius became head of the Weimar School of Arts and Crafts and also of the Weimar Academy of Fine Art, which he very shortly amalgamated into a Hochschule für Gestaltung, or High School for Design, under the name of Das Staatliche Bauhaus Weimar.

Simply stated the Bauhaus was dedicated to the training of artists for the production of beautiful objects of use by the machine, objects which belong essentially to our industrial civilization. I will deal further with the purposes of the school when describing the new Bauhaus buildings erected for the school at Dessau in 1925–6. From 1919 to 1924 Gropius was thus primarily engaged in organizing training at the Bauhaus, and with his duties as a teacher, so that during this period he was responsible for only a little building work. One work which should be noted, however, is the reconstruction of the Municipal Theatre at Jena, which Gropius designed in collaboration with Adolf Meyer, and which was completed in 1923. It is characterized by large plain surfaces, the effect being dependent largely, both in the exterior and interior, on the relations of rectangular masses, the larger masses being solid with a carefully calculated punctuation of voids (Plate LXIX A and B).

Gropius was also engaged on a few projects at this time, the most important of which was for an international academy of philosophical studies (1924), of which a model was made. This building was conceived in reinforced concrete, and was designed strictly in accordance with convenience and the logical sequence of parts. The blocks are long and there is considerable horizontal emphasis by means of balconies. Its distinguishing architectural feature is the relation of these blocks, which afford a satisfying feeling that there is an underlying unity in the scheme.[1]

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[1] A reproduction of this model is given in Siegfried Giedion's *Space, Time and Architecture*, p. 396.

CHAPTER XXVII

Functionalism, New Forms, and Experiments—Industrial Buildings

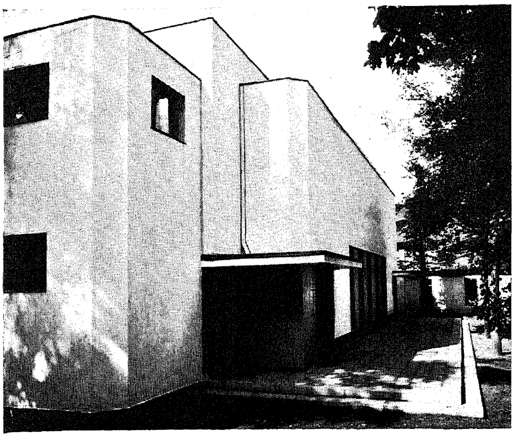
I HAVE already mentioned that, for reasons fully explained, it is chiefly in industrial architecture that functionalism, new forms, and experiments find their most frequent and vigorous expression. We have previously noted the large amount of industrial building by Peter Behrens for the A.E.G. (General Electric Company of Berlin), and that the Turbine factory in the Huttenstrasse, Berlin, particularly, makes a tremendous step forward. In many of Behrens's industrial buildings the classical tradition is strong, and this classical influence gives them a monumental quality. The buildings are partially transitional from the classicism of the old order to the architecture of steel and concrete. Behrens did not break free from this tradition and accept the new idiom so completely as Gropius had done in the Fagus shoe-lace factory, and this classical influence is quite as strong in the large amount of work by Behrens in the period from 1919 to 1924. It is very much transitional work, and I hesitated whether to consider it in the present chapter or in the chapter on the Classical Tradition and Transition. I am considering it here because fundamentally it belongs to the new movement, although influenced by Classicism. The work considered in Chapter XXII, on the other hand, is essentially work in the classical tradition, showing tendencies mainly of a negative character, such as greater simplicity.

Two of the largest buildings by Behrens erected at this time are the I. G. Farbenindustrie Aktiengesellschaft—Chemical Factory and Dye Works—at Höchst-am-Main (1920–4) and the Gutehoffnungshütte—Good Hope building for extracting by-products of coal—at Oberhausen (1921–5). The site of the former building is long, and borders a slightly curving road. The plan is irregular and obviously the aim was to use the site to the best advantage without restrictions that might have been imposed by more formal planning (Plate LXX). The building is a steel-framed structure faced with brick, and brick is used for some of the interior facings. It is employed throughout with a decorative intention that betrays Behrens's affection for the material. In some of the interiors the decorative effect is of a romantic character, as in the grand hall with flute-like forms in bricks of various colours, no doubt to symbolize dyes. There is a definite monumental quality in the exterior that makes one think of some of the old warehouses built in England a hundred years earlier (see Plate LXX).

The immense Good Hope Industries' buildings are of steel frame construction faced with brick, and the decorative pattern of the bricks on the walls again demonstrates Behrens's liking for this material. Probably because Behrens had a more spacious and open site this building is much more formally planned, and symmetrical arrangement has played some part in the design. In one principal block two staircase towers are arranged at regular intervals, and the whole effect is somewhat of rectangular masses building up in classical harmony. In another block, although the planning is of a similar symmetrical kind, there is considerable emphasis on projecting flat roofs, and the effect of the edges is carried on by the introduction of concrete bands, either flush or as string courses, effects not unlike those in some of Frank Lloyd Wright's buildings. The general impression of this building is that it is by an architect who, though conscious of industrial needs and of serving these efficiently is yet by thought and training an architect in the classical tradition (Plate LXIX C and D).

When we consider Behrens's non-industrial work of this period, like the Monastery of St. Peter, Salzburg (1924–5), where the type of building has a long history, the Renaissance tradition is dominant and wholly determines the style. But with the block of flats that he built for the Vienna Council in 1924–5 traditional influences recede, although again in the symmetrical massing the classical feeling is still strong. The type of building is important with Behrens. If the particular type has few precedents, as in some industrial buildings, then functionalism becomes correspondingly more prominent; if the type is rich with precedents, then Behrens's design in style and planning conforms in greater degree with what is traditionally accepted. But none of the work of this kind from 1918 to 1924, not even the dye works at Höchst-am-Main, is so fine an expression of purpose and modern structure as the turbine factory. We shall see later, however, that in the tobacco factory at Linz in Austria Behrens could use steel and glass with a feeling for their structural potentialities and lightness unsurpassed at the time.

Although much industrial building is construction for a special manufacturing process, for a large number of industries there are certain requirements in common, and one of the principal of these is the enclosing of a large space, without or with as few intermediate supports as possible. The open expanse of enclosed space, the large hall as the Germans would say, is a characteristic of much industrial building, and one of the problems of progressive design is to devise light, economical, and efficient structures to span these wide spaces. I will deal with developments in this form of construction during the nineteen-twenties and early thirties in a future chapter.



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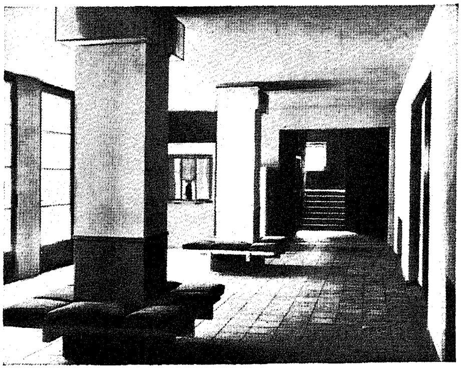

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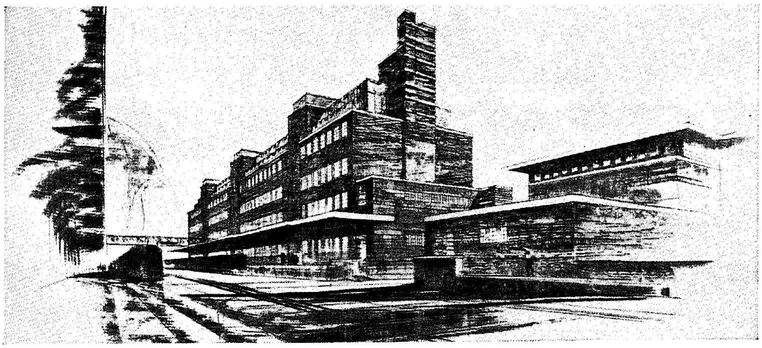

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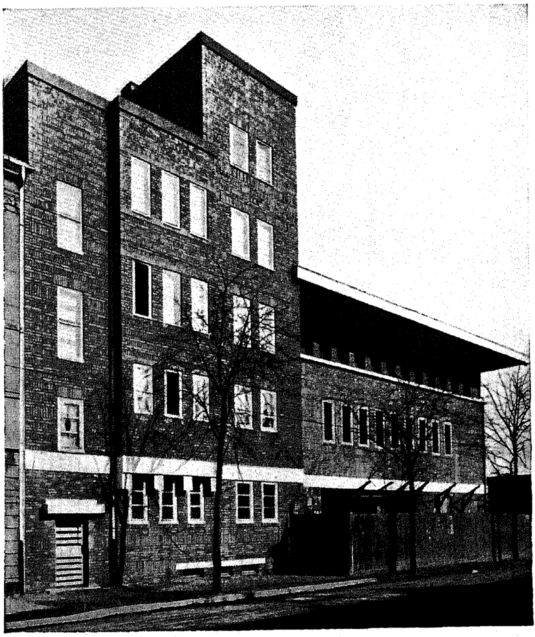


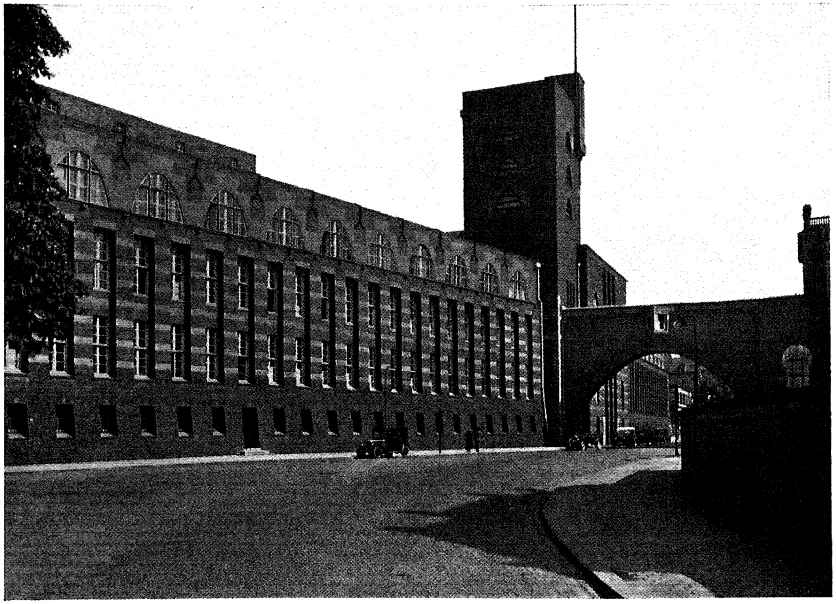
A. MUNICIPAL THEATRE AT JENA
Architects: WALTER GROPIUS AND ADOLF MEYER (1923)

B. VESTIBULE OF SAME BUILDING

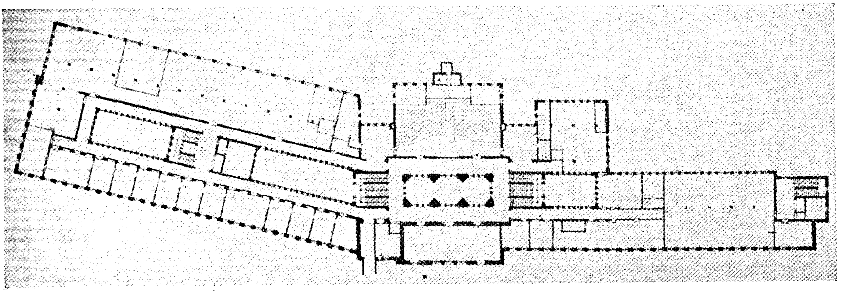
C. GENERAL VIEW OF THE GOOD HOPE BUILDING AT OBERHAUSEN FOR EXTRACTING BY-PRODUCTS OF COAL
Architect: PETER BEHRENS (1921–25)

D. DETAIL OF A BLOCK OF THE SAME BUILDING

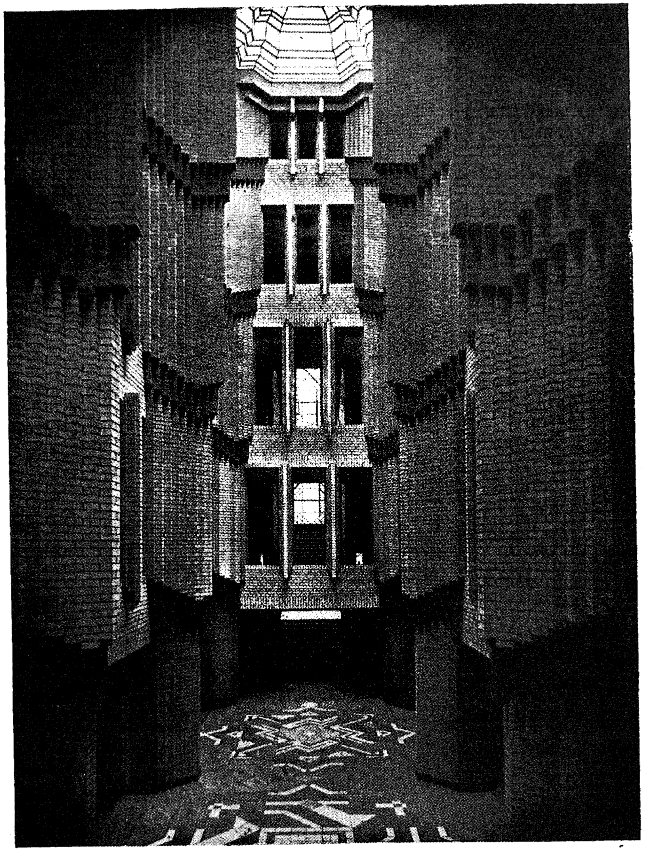
PLATE LXIX



CHEMICAL FACTORY AND DYE WORKS AT HOCHST-AM-MAIN
Architect: PETER BEHRENS (1920–24)



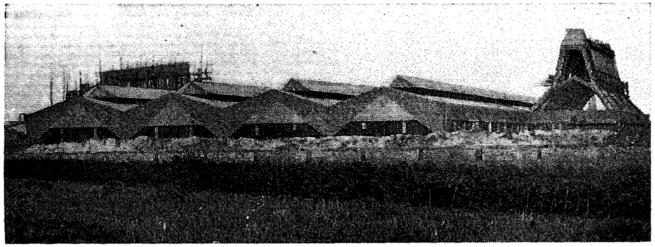
A PLAN OF THE SAME BUILDING



THE GRAND ENTRANCE HALL OF THE SAME BUILDING, SHOWING BEHRENS'S VERY COMPLICATED USE OF BRICK. THIS BUILDING, LIKE THE GOOD HOPE BUILDING (ILLUSTRATED ON PLATE LXIX) IS STEEL-FRAMED, FACED WITH BRICK

PLATE LXX

A



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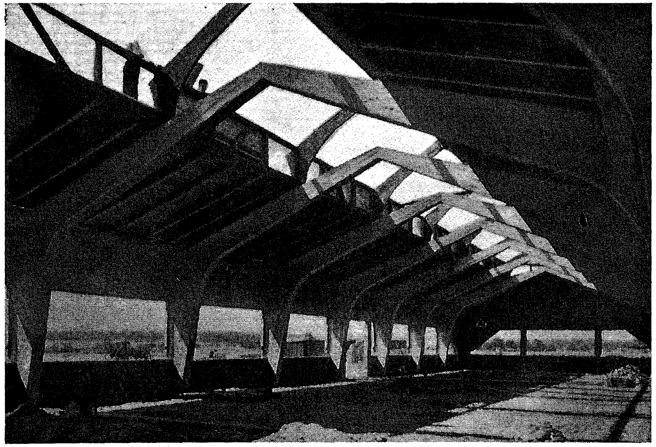

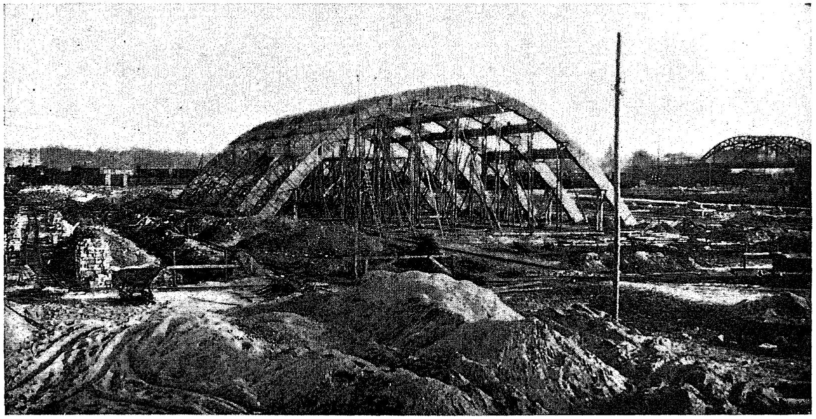

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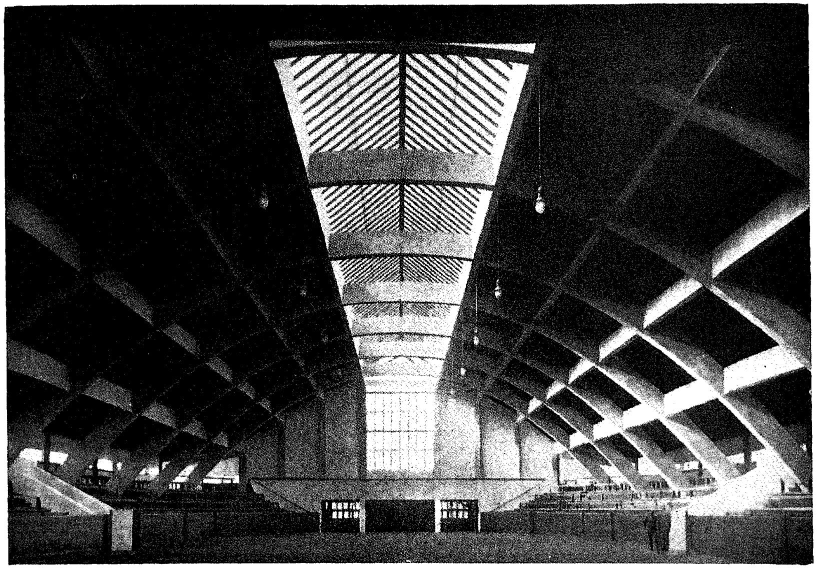


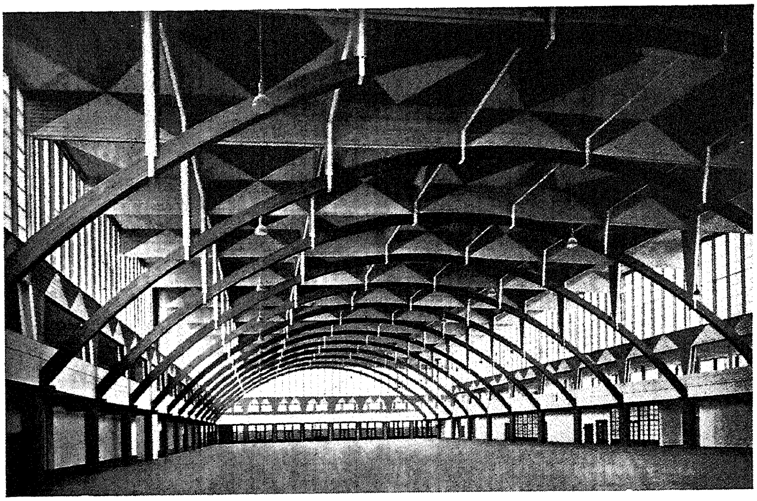
D

A AND B. HAT FACTORY, LUCKENWALDE (1921). *Architect:* ERIC MENDELSOHN

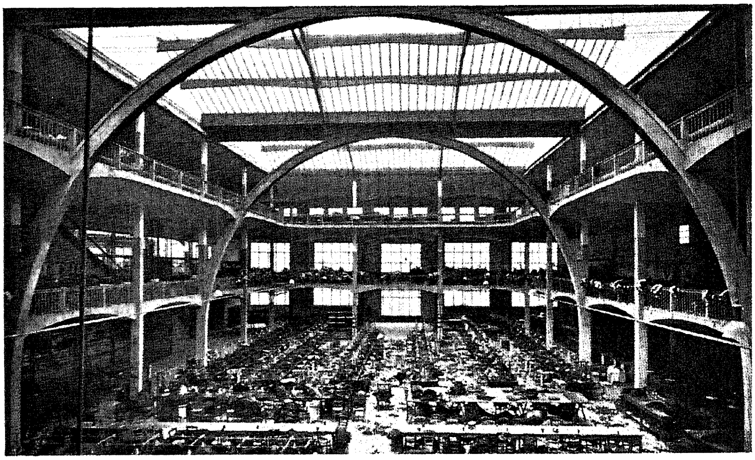
A. SHEDS WITH DYE-VAT IN CONSTRUCTION. B. CONSTRUCTION OF SHEDS IN REINFORCED CONCRETE

C AND D. HALL AT MAGDEBURG FOR AGRICULTURAL EXHIBITIONS AND SPORT (1922): FERRO-CONCRETE WITH JOINT-BINDERS
Architects: BRUNO TAUT AND J. GÖDERITZ
C. PROGRESS VIEW. D. THE FINISHED HALL

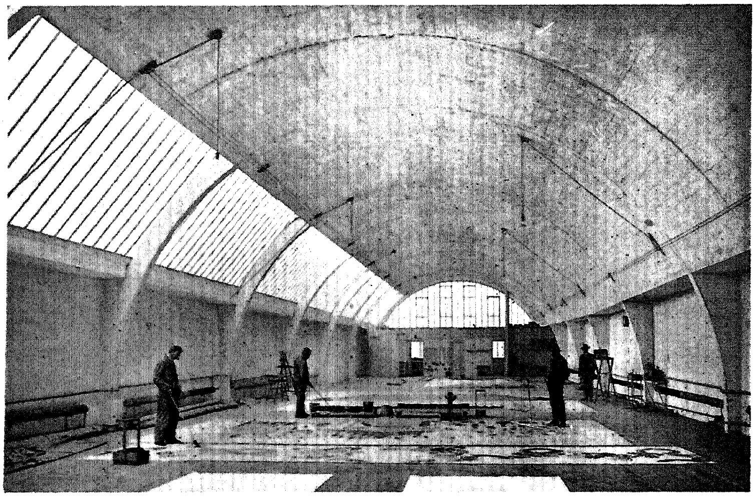
PLATE LXXI



HALL FOR FAIRS AT BRESLAU, CONSTRUCTED IN WOOD (1924)
Architect: MAX BERG



CLOTHING WORKSHOP IN PARIS (1919)
Architects: AUGUSTE AND GUSTAVE PERRET



STUDIO FOR SCENIC DECORATORS, PARIS (1923)
Architects: AUGUSTE AND GUSTAVE PERRET

PLATE LXXII

Meanwhile we should note some of the interesting halls of different types that appear in industrial and exhibition buildings during the period under review.

We have noted how the construction of roof spans in the nineteenth century culminated in the Galerie des Machines of 1889 with its span of 378 feet. This remarkable engineering feat has not so far been surpassed, and the spans of halls for factories and exhibition buildings are generally considerably less. Progress has been made, however, in the greater lightness of structure and greater economy of material.

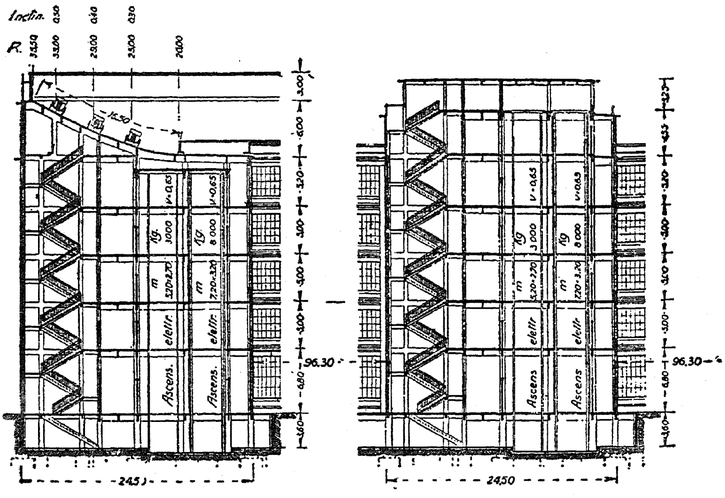
The principle of construction in which ribs of steel or reinforced concrete spring from the floor was followed in many industrial halls built in this period between 1919 and 1924. We have seen that in the roof of St. Pancras Station of 1868 the arches spring from wall corbels; in the Galerie des Machines of 1878 from iron columns, the upper part of the wall being part of the roof girder which turns to a pitch of 20 degrees. The next stage of resting this girder on the floor was realized in the Galerie des Machines of 1889. The reinforced concrete parabolic arches of the airship hangars at Orly (1916) were a variation on the same theme (Plate XXX) and a considerable number of further variations were made shortly after the war, principally in Germany and France.

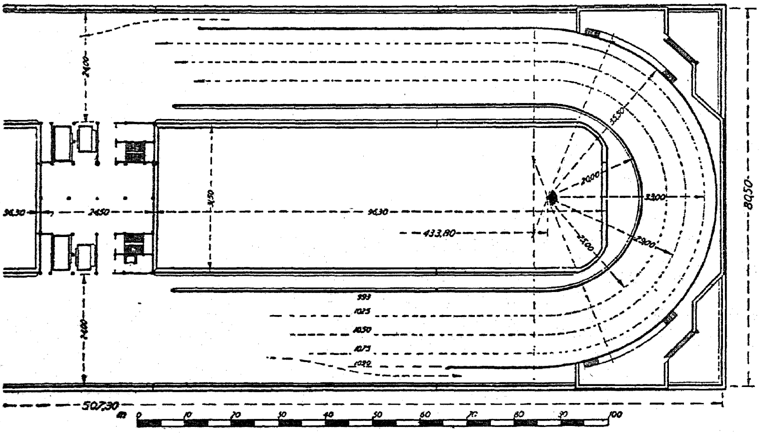
An interesting factory in which a variant of this rib construction is employed is the hat factory at Luckenwalde, built by Eric Mendelsohn in 1921 (Plate LXXI). The factory consists of four long sheds and a dye works built parallel. The sheds are built of a series of reinforced concrete arches springing from the floor on the same principle as the Paris Exhibition buildings. The construction is clearly shown in the illustration. The dye works represents a special construction devised for efficient use. It consists of two tiers of concrete arches, the upper supported on the lower. This construction was devised to provide a drying-loft, and special ventilation produces a stream of air along its whole length, so that a kind of wide chimney is provided. Here is a building designed strictly according to the purpose it has to serve; how much thought was given to pleasing appearance it is difficult to determine, but there is little doubt that the clear structural lines of the arches in particular are not without beauty.

Among other industrial and exhibition buildings of this period in which the hall motif is prominent are the Agricultural and Sports Hall built by Bruno Taut and Johannes Göderitz in 1922, the Hall for Fairs at Breslau built by Max Berg in 1921, a clothing workshop (1919), and a scenic decorators' workshop in Paris (1923) built by Auguste and Gustave Perret. The first-mentioned hall has segmental arched ribs of reinforced concrete

PART PLAN AND SECTIONAL DRAWINGS OF THE FIAT FACTORY, NEAR TURIN (1919–1922)

Architect: MATTE TRUCCO





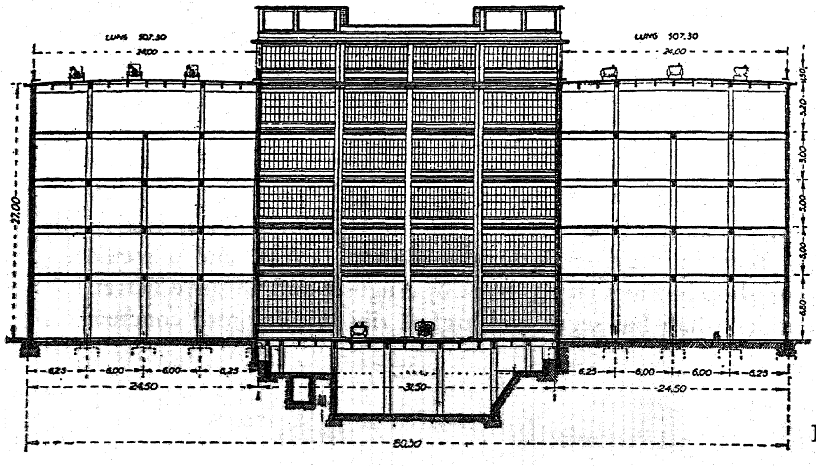


PLATE LXXIII

held together by transverse ribs. As will be seen from the illustration (Plate LXXII) the interior effect is impressive. A similar low segmental arch is used in the Hall at Breslau by Max Berg constructed of wood, but here the arches are carried on short columns, and a flat roof is clipped to the arches and held firmly in position by them. The Perret brothers in their two Paris workshops mentioned use the semicircular arch. In the clothing factory it is a reinforced concrete frame structure with balconies round the central space, while the semicircular arches serve to hold the flat roof in position as in the Hall at Breslau. In the decorators' workshop the semicircular ribs determine the internal form of the building. Where the arches are just structural and there is no attempt to let the general form follow them, as in the Paris clothing factory, the aesthetic effect is far less agreeable than where the form follows the arches, as in the Hall at Magdeburg, and the decorators' workshop in Paris. Such interiors have some degree of beauty, and if fairly large, as in the former case, are definitely impressive.

The largest European factory built at this time, and one that provides an example of design controlled solely by industrial purpose is the Fiat Automobile Factory at Lingotto, near Turin, built in 1919–22. The design is the interpretation by the architect, Matte Trucco, of the ideas and requirements of the President of the Fiat Company, G. Agnelli (Plate LXXIII).

Of reinforced concrete frame construction the factory is about one and a quarter miles in length. It is designed for the logical sequence of operations in production, from the entrance of the raw material to the testing of the automobiles. At either end of the building, which is five stories in height, is a special ramp from the basement to the roof (see vertical sections) on which there is a testing track 78 feet wide and banked at either end to afford scope for high speeds (Plate LXXIV). The façades of the building have the gridiron appearance formed by the concrete frame and the floors. Four light wells are formed in the centre of the building, or, to vary the description, the centre of the building between the tracks is open, and three blocks connecting the long side blocks are introduced at regular intervals, each of which rises higher than the track and provides access to it. Here is an example in which almost exclusive consideration of purpose has determined the design of the building, and it demonstrates more than any amount of argument why it is that in modern industrial building we have the basis of a true contemporary and living architecture. This particular building may not be architecture, because it may not afford aesthetic pleasure to many people—although it may to some—but it provides the true basis from which a great contemporary architecture can arise.

CHAPTER XXVIII

Functionalism, New Forms, and Experiments—Ecclesiastical and Domestic

WE have noted in Chapter XXIV, when considering ecclesiastical architecture of the period, a departure in many examples from the cross plan to the rectangular plan with or without arcaded aisles. In the examples considered this rectangular plan was accompanied by a traditional method of building with a simplified traditional style. In France, and later elsewhere, this tendency to plan churches more in accordance with suitability for modern purpose was beginning to be accompanied by the use of new materials and methods of construction and design resulting logically from this. The two most noteworthy early examples in which there is a wholehearted attempt to apply the methods for industrial building to modern churches are the church of Nôtre Dame de Raincy, near Paris, built in 1922–3, and the church of Ste Thérèse at Montmagny, built in 1924–5, both by Auguste and Gustave Perret. Both have the rectangular plan with a tower in the centre at the west end and both are constructed of reinforced concrete. In the earlier church at Le Raincy, which is very much the prototype of that at Montmagny, the essential principle of the construction is a roof supported on two double rows of straight, slender columns, the outer rows forming the walls, while between the columns are latticed windows. The roof has a flat segmental vault in the centre, with a series of transverse segmental vaults at the sides, giving the slight reminiscence of bays. Above the plinth, which is about 7 feet high, the walls are almost entirely composed of the geometric latticed windows, and this contributes to the light and open effect of the interior. The tower is in three stages, and its character is very largely determined by the slender rod-like columns. A long window forms a panel in the first stage, a ventilator in the second, with the termination consisting of three vertical concrete rods and decorative fret panels formed to buttress a slender tower (Plate LXXV A and B).

The motif of the long, plain, slender columns of the interior is thus repeated in the tower. The design, especially the treatment of the columns, has proved very disturbing to many traditionalists. For example, A. Trystan Edwards criticizes the design of the tower,[1] which, he says, 'is so strangely composed that it appears to suffer from a mechanical instability'. This impression, which, by the way, is not now easy to understand, may be due to judging a reinforced concrete structure according to appearances of stone or brick construction, which is illogical. But what Trystan Edwards particularly criticizes is the lack of vertical punctuation and the lack of terminal features for the long, straight concrete ribs, and he contends that the lack of such punctuation gives rise to the idea that the stages are capable of sliding downwards in telescopic fashion. Associations of this kind, often far more ludicrous, do impose themselves in the contemplation of objects, and this often disturbs aesthetic enjoyment; but it is questionable whether it is valid criticism. Is it essential that a column or vertical rib shall be punctuated with accented terminations? It is true that it is a feature of columns from Ionic to Gothic, but there was no lower punctuation of the Doric columns, while many square Egyptian columns have none, and in much important modern architecture there is no such punctuation. What is far more important is that the column shall be in good proportion to what it supports, a matter which depends on the effect of adequacy of the supporting member. If it appears too weak for efficient support it can hardly be good proportion; if it appears to have unnecessary bulk for what it supports, again the proportion is unsatisfactory. The happy medium is the good proportion, the feeling that it is just right. But it must be related to material. The structural capacities of stone and steel are very different; therefore the delight one has in the good proportion of a structure must necessarily be associated with the feel of the material, the feel of stone which requires a certain bulk for support, the feel of steel, or steel embedded in concrete which requires much less bulk and can be comparatively slender. Traditionalists looking at the tower of the church at Le Raincy are apt to judge it by towers where the walls support and are structural, whereas here they are screens on a framed construction. The vertical ribs criticized by Trystan Edwards are the uprights of the frame, and they are given more prominence than the horizontal members because vertical emphasis was desired. What the architects were clearly anxious to do was to get a pleasing proportional sequence in the three stages of the tower. The same attitude that could not think of Mendelsohn's sketch designs of steel and concrete buildings as architecture finds it difficult to appreciate a church of this kind as architecture. H. P. Cart de Lafontaine, though admitting that this church suggested many possibilities, says that it 'is primarily engineering'.[1] The difficulty, as we have seen, is to judge a work on its own merits; that is, as an expression of purpose and structure and as a composition of forms, without reference to past standards and traditional practice.

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[1] *Style and Composition in Architecture* (London, 1944), p. 60. This is the second edition of *Architectural Style* (London, 1926).

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[1] *The Journal of the Royal Institute of British Architects*, 5 Dec. 1925, p. 71.

As previously indicated the church of Ste Thérèse at Montmagny follows the same principles of design and construction, although it varies in many details. The same geometric lattice work is used for the windows, indeed, the same moulds were employed as in the church at Le Raincy. The first two stages of the tower are similar, but the terminating stage is much simpler and finishes with a pyramid and cross.

Following similar principles of interior design and construction is the famous church of S. Antonius at Bâle in Switzerland, built by Karl Moser in 1924–5. I should be very surprised if Moser, before designing this church, had not seen the church at Le Raincy. It is a reinforced concrete frame construction and the roof, like that at Le Raincy, is supported on two double rows of long, slender shafts. In the centre is a barrel vault of ribbed construction, forming a pattern of square panels, while the roof between the wall and inner row of shafts is flat with the same ribbed construction. The uprights on the walls are in pairs, which form a flat wall between windows. Two principal entrances are at the sides, and the porches rise to the full height of the walls, with a roof stepped down to the entrances and a series of diminishing shafts on the inside of the porch side walls. The tower is at the other end, and the side is plain (oblong on plan) with a perforated termination. Where, in the churches by Perret, a stylistic motif is the slender, round column or rib, in the Bâle church there is a slender, square column or rib, and the whole church is largely rectangular in character—a calculated relation of horizontals and verticals, with a decided emphasis on the latter which is employed very impressively in the two porches. I think it must be admitted that Moser's church has an artistic unity and distinction superior to the earlier French churches, but the originality belongs primarily to the Perret brothers. It would seem that the theme was given to Moser by Auguste and Gustave Perret, and he has produced a beautiful variation of the theme (Plate LXXVI).

Housing, in the form of blocks of flats, rows of small houses, and individually designed houses, does not present a very large number of examples in this period from 1919 to 1924 that may be said to belong to the new architecture. From 1921 onwards the examples became less rare, but it is from 1925 onwards that they are at all numerous. The most noteworthy between 1919 and 1924 are some blocks of flats at Rotterdam, and rows of houses at the Hook of Holland by J. J. P. Oud, houses in La Cité Moderne at Brussels by Victor Bourgeois, some blocks of flats in Vienna by Josef

Frank, and a few early houses by Le Corbusier, namely, that at Vaucresson built in 1922, the house for the painter Ozentant built in the same year, and two houses at Auteuil built in 1923. I will deal with these in Part III as they can then be considered in sequence with Le Corbusier's other houses. Several of the many schemes, important architecturally, like the flats of the 'Gehag' in Berlin and the houses at Stuttgart were not commenced until 1925 and 1927.

J. J. P. Oud became housing director of Rotterdam in 1918, and shortly afterwards built several blocks of flats for workmen. The large block known as 'Tusschendyke' was built in 1920. In its directness, simplicity, and purity, in which all ornamental effects are eschewed, it offers a mild contrast to the romanticism of the Amsterdam flats of de Klerk and Kramer. Yet it does not represent a full utilization of structural possibilities, and the somewhat small vertical windows which occupy the street façade and the upper part of the façades facing the inner court are traditional types. The same can be said of the flats of Josef Frank, built in and around Vienna (Altmannsdorf 1921, Hetyendorf 1922, Traiskirchen 1922, and Kongressplatz). These flats of Oud and Frank and those of Behrens previously referred to are rather transitional in character, and do not yet represent a full acceptance of the new structural possibilities.

In a letter written in 1923 Eric Mendelsohn makes some interesting and highly personal comments on the contrast between Oud's work at Rotterdam and contemporary work at Amsterdam. He speaks of Oud as functional and coldly objective and Amsterdam as dynamic and visionary, and suggests the value of reconciliation between the two. 'Both are necessary', he says, 'and both must find each other. If Amsterdam goes a step farther towards ratio, and Rotterdam's blood does not freeze, then they may unite. Otherwise, Rotterdam will pursue the way of mere construction with deathly chill in its veins, and Amsterdam will be destroyed by the fire of its own dynamicism. Function, plus dynamics, is the challenge.' It is characteristic of Mendelsohn to place this emphasis on dynamic qualities, and I think his requirements would be partially met in the workers' houses at the Hook of Holland, built by Oud in 1924–5. Here definitely is a dynamic quality, while full advantage of modern construction is taken in the design.

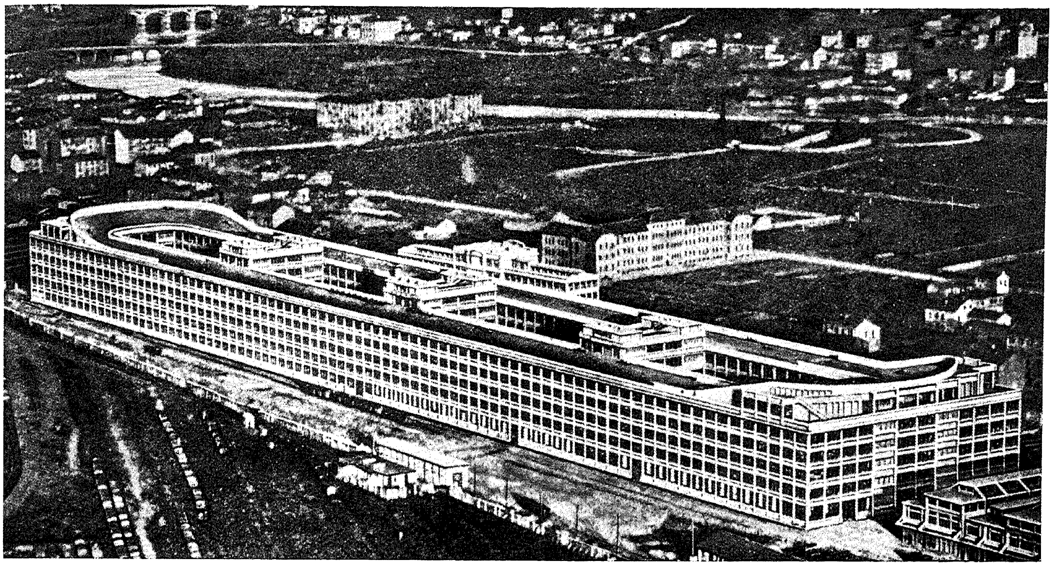
The planning of each unit is extremely ingenious, as much as possible being introduced into a too severely restricted space. The houses are built of concrete in long rows, with a balcony on the first floor, the unbroken line of which emphasizes horizontal effect. The ends of the blocks form stores. They are curved and have entire glass screens on the ground floor. Large horizontal windows are used, the spacing of those on the first floor in relation to the plain wall being particularly happy, while the houses compose into an effective whole (Plate LXXVII).

La Cité Moderne in Brussels, built by Victor Bourgeois in 1921–2, composed of rows of one- and two-family, two-story houses, and three-story flats, represents a planned development and a conception of house blocks that seems to owe something to Tony Garnier's Cité Industrielle. The houses are built of brick with flat roofs, the windows are fairly large, horizontal rectangles, almost square, and diagonal projections are used in several of the houses to capture light. But here again there is a tentative note and the houses from this distance of time have a transitional character (Plate LXXVII).

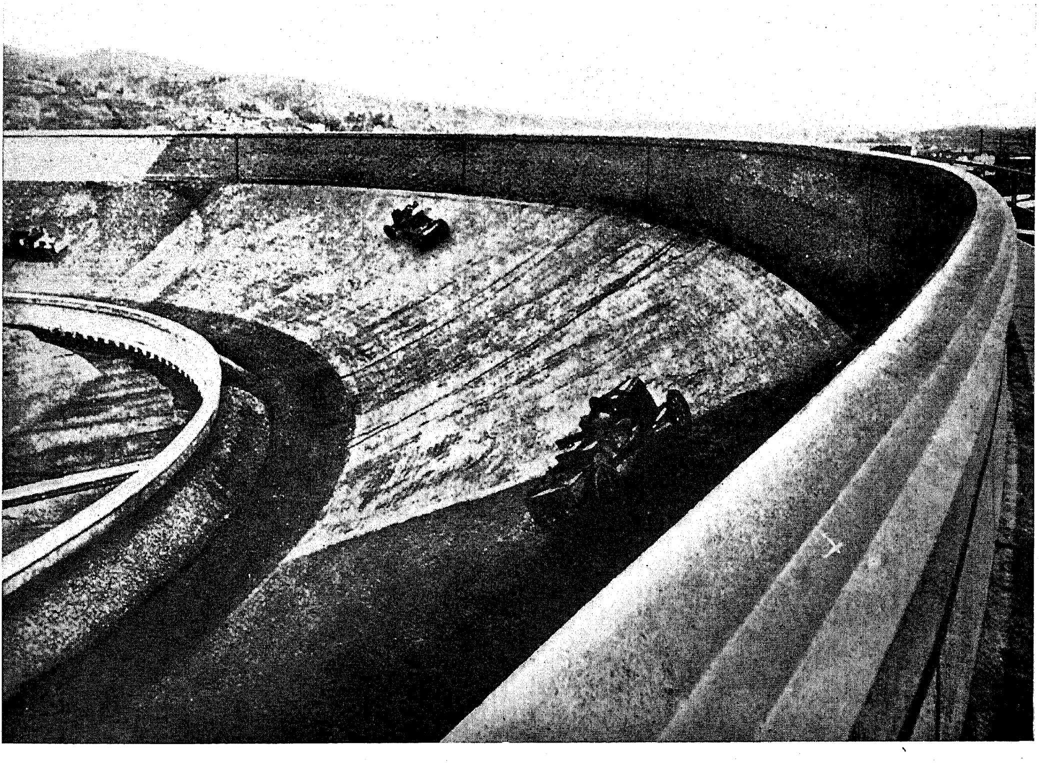
The period from 1919 to 1924 is not one of great architectural progress or achievement—conditions were against that. Although there was a tremendous amount of building to be done, and most countries had a big programme, Europe was generally slow in getting a start after the great upheaval of the war. As far as a progressive movement like that of the new architecture is concerned, it cannot be said that there was much advance during this six years. Rather the work of this period consolidated the stage reached before the war. It is in the period from 1925 to 1932 that real advance was made when the volume of building was much greater. This was a period of considerable constructional and architectural achievement.

Did the First World War contribute much to architectural progress? If we consider the movement towards a living architecture that had been growing in the years before the war, it merely served to arrest for a time that movement, and we cannot say that any real advance was made until five years after the end of the war. But for the war the movement would surely have been a continuous development, and we may say, I think, that it served to retard that development. But there is another side to the picture. An upheaval like the war produced, in the defeated countries, a re-examination of values, and less willingness to accept standards of the past that had not served them too well. There was consequently less respect for tradition, and this state of mind probably effected a readier acceptance of new forms more expressive of contemporary life.

There is one other effect of the war on building and architecture which is important. The war produced a general desire for higher social standards, especially for those who had not enjoyed good standards in the past. Higher social standards mean better and more spacious housing accommodation, better health services, more social amenities. All this means more building to satisfy these requirements. This was so in every European country, but



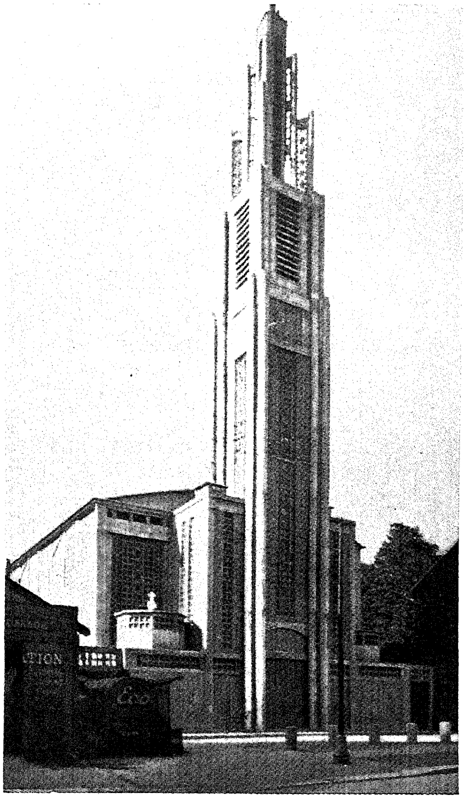
AN AERIAL VIEW OF THE FACTORY



THE TRACK FOR TESTING CARS WHICH IS CONSTRUCTED ON THE ROOF OF THE BUILDING

THE FIAT AUTOMOBILE FACTORY AT LINGOTTO, NEAR TURIN (1919–22)
Architect: MATTE TRUCCO

PLATE LXXIV



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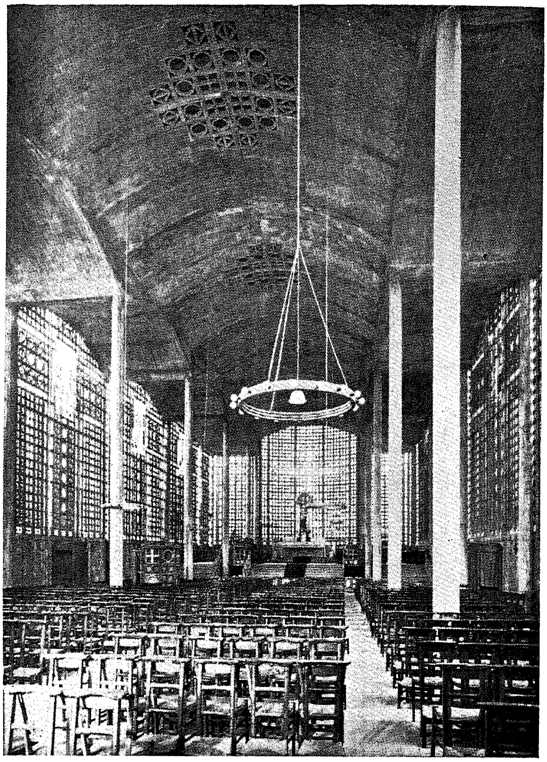

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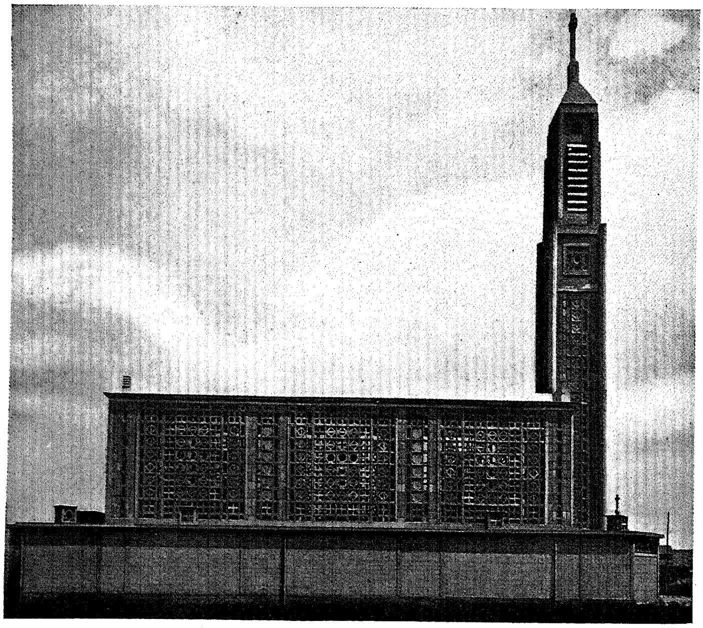


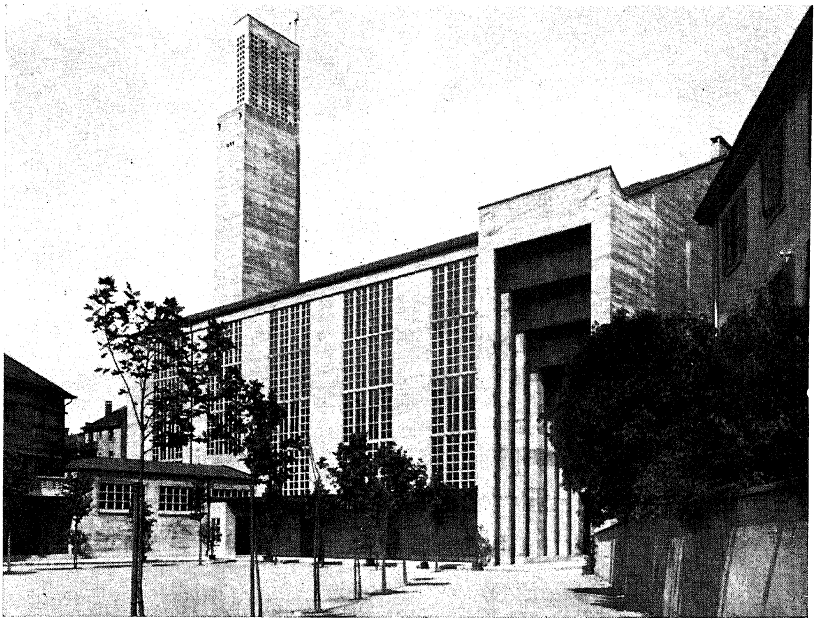
C

A. THE CHURCH OF NÔTRE DAME DE RAINCY, NEAR PARIS (1922–23) *Architects*: AUGUSTE AND GUSTAVE PERRET

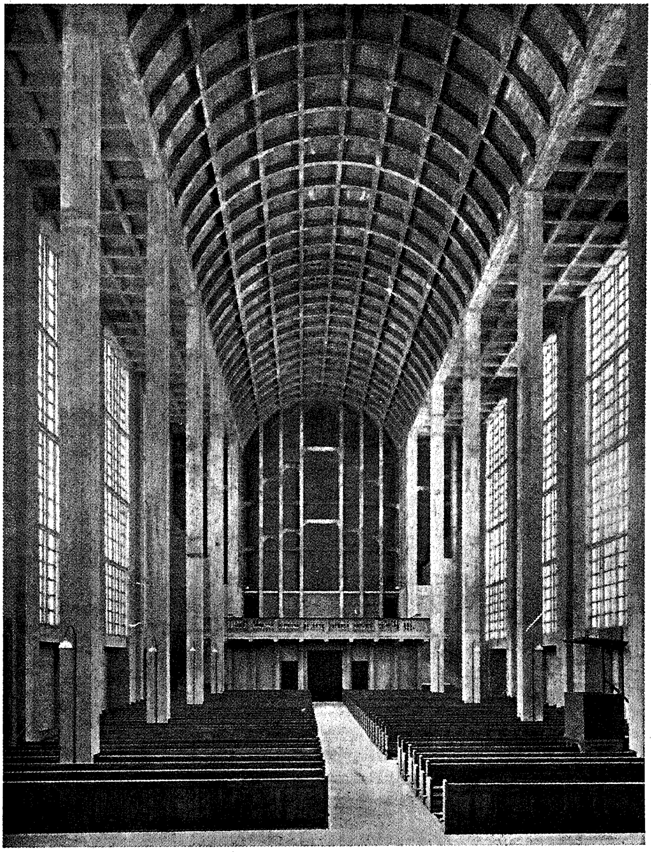
B. INTERIOR OF THE SAME CHURCH. (*This Church should be compared with the Church of St. Antonius at Bâle in Switzerland.*)

C. THE CHURCH OF STE THÉRÈSE DE L'ENFANT JÉSU AT MONTMAGNY (1924–25) ALSO BY AUGUSTE AND GUSTAVE PERRET

PLATE LXXV



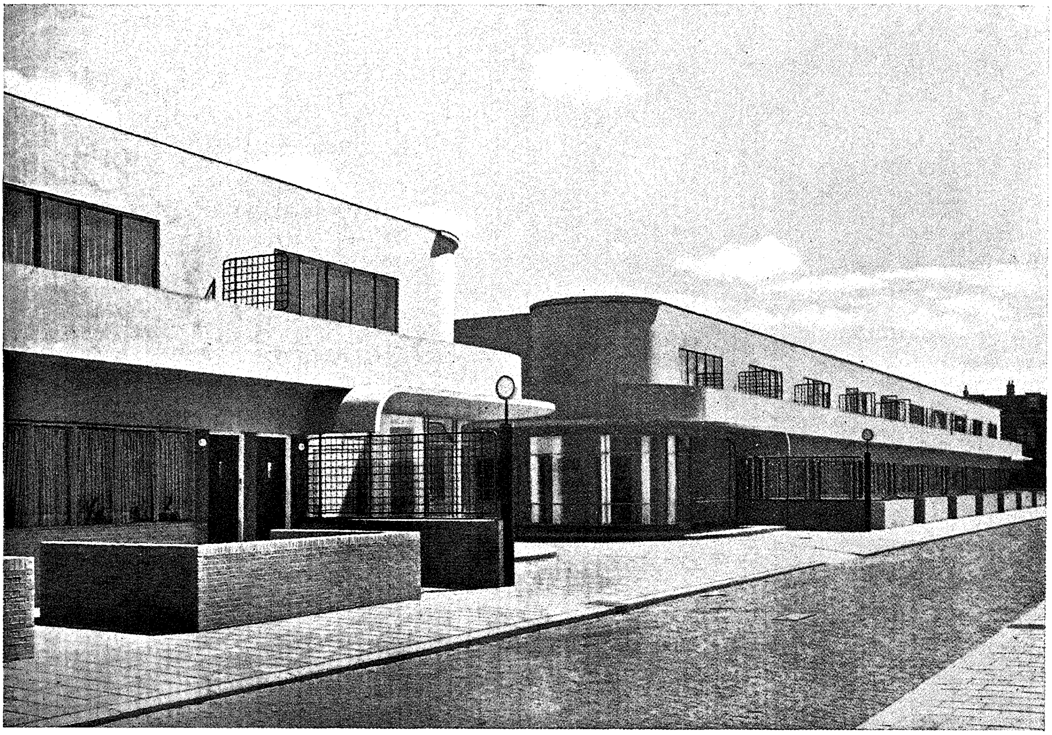
CHURCH OF ST. ANTONIUS AT BÂLE (1924–25)
Architect:
KARL MOSER



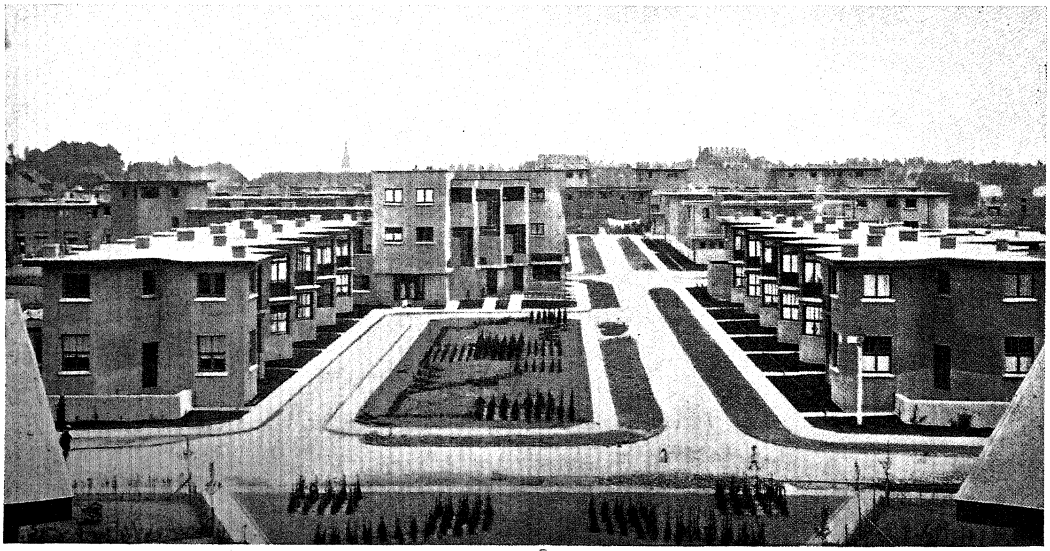
INTERIOR VIEW OF THE SAME CHURCH

(*Note: This interior should be compared with that of the Church at Raincy illustrated on the previous Plate.*)

PLATE LXXVI



TERRACE HOUSES FOR WORKMEN AT THE HOOK OF HOLLAND (1920). *Architect*: J. J. P. OUD



LA CITÉ MODERNE IN BRUSSELS, COMPOSED OF HOUSES AND FLATS (1921–22). *Architect*: VICTOR BOURGEOIS

PLATE LXXVII

the change was probably greatest in Russia, where the Revolution in the interests of the majority was greater than elsewhere. This general desire in Europe for higher social standards had, therefore, a tremendous effect on the volume of building. It was not apparent at once owing to the difficulties of political adjustments and economic reconstruction, but it began to manifest from 1925 onwards. It is very doubtful if the volume of building in Europe from 1925 to 1939 would have been so great but for that legacy of the war that required a higher standard of living for the common man.

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Most of the works selected here cover the period from about the middle of the last century to about 1925. Some of the works deal mainly with a slightly later period, but they are included because they contain some references to, and illustrations of, work before 1925. Many important works on modern architecture are not included here because they belong more rightly to the bibliographies of the second and third volumes.

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AESTHETICS OF ARCHITECTURE

BOOKS dealing mainly with the aesthetic aspects of architecture may for convenience be divided into three categories:

1. Books dealing generally with architecture or with a particular development or historical period in which some consideration is given to aesthetic questions. In this category are many of the books already given under the general heading, like Siegfried Giedion's *Space, Time, and Architecture*; Talbot Hamlin's *Architecture an Art for all Men*; Walter Curt Behrendt's *Modern Building*; Nikolaus Pevsner's *Pioneers of the Modern Movement*; R. A. Duncan's *The Architecture of a New Era*; A. S. G. Butler's *The Substance of Architecture*; and Frederick Towndrow's *Architecture in the Balance.* The value of the contributions to the aesthetics of architecture in these books depends to a considerable extent on the author's understanding of the general philosophy of art. The first four can be recommended as having this necessary philosophic background.

2. Books dealing with architecture mainly or exclusively from the aesthetic standpoint. The best modern book in English of this kind is Geoffrey Scott's *The Architecture of Humanism,* London, 1914, in which the author endeavours to demonstrate the fallacies of valuing architecture by standards other than aesthetic which he bases on the theory of Einfühlung.

   Other books in this category are: C. Braydon, *The Frozen Fountain,* Essays on architecture and the art of design in space, New York, 1932; Robert Byron, *Appreciation of Architecture,* London, 1932; T. H. Lyon, *Real Architecture. The rights and wrongs of Taste,* Cambridge, 1932; O. Schubert, *Architektur und Weltanschauung,* Berlin, 1931; A. C. W. Walton, *Architecture and Music,* A Study in reciprocal value, Cambridge, 1934.

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3. Books on aesthetics and the philosophy of art. These can be broadly classified as (*a*) Outlines or expositions of the main aesthetic theories and philosophic systems in which beauty figures prominently, and (*b*) Books devoted to the particular aesthetic theory or philosophic system of its author.

   (*a*) Three of the best expositions in English of the principal aesthetic theories are: Bernard

Bosanquet, *A History of Aesthetics*, London, 1892; E. F. Carritt, *The Theory of Beauty*, London, 1914. Third edition revised 1928; Lord Listowel, *A Critical History of Modern Aesthetics*, London, 1933. A good statement of some of the principal theories is that of James Sully in the eleventh edition of the *Encyclopaedia Britannica* (1911).

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(*b*) The aesthetic theories which have had the greatest influence since Ancient Greece, and which have been variously classified (see works in category (*a*)) are those of Plato (chiefly *Republic*, Books, 2, 3, and 10), Aristotle (*Poetics*), Plotinus (*Enneads*), Kant (*The Critique of Judgment*), Schopenhauer (*The World as Will and Idea*), Hegel (*Aesthetics*), Tolstoy (*What is Art?*), Ruskin (principally *Modern Painters*, *Seven Lamps of Architecture*, and *Stones of Venice*), Lipps (*Einfühlung—Inward Initiation and Sense Feelings*).

Of modern writers on aesthetics whose work belongs mainly to the twentieth century among the most influential are A. C. Bradley (*Oxford Lectures on Poetry*), B. Croce (*Aesthetics*, *A Breviary of Aesthetics* and the article on Aesthetics in the fourteenth edition (1929) of the *Encyclopaedia Britannica*), Roger Fry (*Vision and Design*), George Santayana (*The Sense of Beauty*), Samuel Alexander (*Space, Time, and Deity* and *Beauty and other Forms of Value*), A. N. Whitehead (*The Adventure of Ideas*), Giovanni Gentile (*The Philosophy of Art*), and Herbert Read (*Art and Industry* and *Art and Society*).

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